US Army Corps
of Engineers®
New England District

EPA
Region 1, New England

Third Five-Year Review Report
for
Mottolo Pig Farm Superfund Site
Town of Raymond, Rockingham County, New Hampshire
August 2008

Prepared by
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Prepared for
United States Environmental Protection Agency
Region I-New England
Boston, Massachusetts

Approved by:

James T. Owens III, Director
Office of Site Remediation and
Restoration

Date:

August 26, 2008

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LIST OF ABBREVIATIONS AND ACRONYMS

µg/L	micrograms per Liter
AGQS	Ambient Groundwater Quality Standards
ARARs	Applicable or Relevant and Appropriate Requirements
BDL	Below Detection Limit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
COCs	Contaminants of Concern
CWA	Clean Water Act
DCA	Dichloroethane
DCE	Dichloroethene
EPA	Environmental Protection Agency
FDDA	Former Drum Disposal Area
Ft	Feet
FYR	Five Year Review
GC	Gas Chromatograph
GMZ	Groundwater Management Zone
HHRA	Human Health Risk Assessment
HI	Hazard Index
IC	Institutional Control
MCL	Federal Maximum Contaminant Levels
Mg/kg	milligrams per kilogram
NA	Natural Attenuation
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NH	New Hampshire
NHDES	New Hampshire Department of Environmental Services
NPL	National Priorities List
O&M	Operations and Maintenance
ORP	Oxidation-Reduction Potential
OSHA	Occupation Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
ppb	parts per billion
PRPs	Potentially Responsible Parties
RA	Remedial Action
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
ROD ICL	Record of Decision Interim Cleanup Level
SARA	Superfund Amendments and Reauthorization Act
SBA	Southern Boundary Area
SDWA	Safe Drinking Water Act
Site	Entire Mottolo Property
SVE	Soil Vapor Extraction
TBC	To be considered
TCA	Trichloroethane
TCE	Trichloroethene

THF	Tetrahydrofuran
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
VC	Vinyl Chloride
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

The components of the remedy for the Mottolo Pig Farm Superfund Site (Site) located in Raymond, New Hampshire, as described in the Record of Decision, are:

- Institutional controls, including land use restrictions to limit site access and future groundwater use/exposure;
- Installation of a groundwater interceptor trench, two temporary soil caps and a soil-vapor extraction system;
- Natural attenuation (NA) of groundwater;
- Long-term sampling and evaluation of groundwater and surface water to assess compliance with cleanup levels through natural attenuation. Cleanup levels were estimated to be attained after six years for the overburden aquifer system, and two years for the bedrock aquifer system.

The Site achieved construction completion with the signing of the Preliminary Close-Out Report September 30, 1993. The first Five-Year Review (FYR) was completed in September 1998. The second FYR was completed September 10, 2003 and serves as the trigger date for the current FYR. This third FYR was performed to determine if the selected remedy continues to be protective of human health and the environment.

Based on information contained in this FYR, the remedy is no longer protective because of persistence and increases in some Contaminants of Concern (COC) concentrations in groundwater from several monitoring wells since the last FYR. Analysis indicates that natural attenuation has not occurred uniformly across the Site over the last five or more years and the estimated cleanup times as specified in the ROD have not been achieved. Also the clean-up objective for arsenic in groundwater was lowered from 50 µg/L to 10 µg/L; however, there are no known exposures occurring due to any of the Site-related COCs for groundwater. The immediate threats from soil were addressed by completed remedial activities. Residential development around the site continues with increasing pressures on the groundwater resources that may increase the likelihood of exposure.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site name: Mottolo Pig Farm Superfund Site		
EPA ID: NHD980503361		
Region: 1	State: NH	City/County: Raymond/Rockingham

SITE STATUS			
NPL status: X **Final** Deleted Other (specify)			
Remediation status (choose all that apply):	Under Construction	Operating	Complete X
Multiple OUs?* YES X NO	**Construction completion date:** 30 September 1993		
Has site been put into reuse? YES **X** NO			

REVIEW STATUS	
Lead agency: X EPA State Tribe Other Federal Agency	
Author name: US Army Corps of Engineers	
Author title: Five Year Review Manager	**Author affiliation:** New England District
Review period:** 11/20/2007 -	
Date(s) of Site inspection: 12/13/2007	

Type of review: Policy

X	Post-SARA		Pre-SARA		NPL-Removal only
	Non-NPL Remedial Action Site		Regional Discretion		NPL State/Tribe-lead

Review number: 1 (first) 2 (second) **3 (third) X** Other (specify)

Triggering action:

	Actual RA Onsite Construction at OU #____	Actual RA Start at OU#	
	Construction Completion	Previous Five-Year Review Report	X
	Other (specify)		

Triggering action date *(from CERCLIS)*: September 10, 2003

Due date *(five years after triggering action date)*: August 26, 2008

* ["OU" refers to operable unit.]
** [Review period should correspond to the actual start and end dates of the Five-Year Review in CERCLIS.]

FIVE-YEAR REVIEW SUMMARY FORM, CONT'D.

Issues:

Potential residual source areas in soil and/or weathered bedrock. May affect offsite and onsite groundwater quality, and potentially impact surface water quality in Brook A where only limited sampling has occurred.

Insufficient sampling to determine seasonal groundwater and surface water contaminant variation and to assess potential mobilization of contaminants onsite (near Brook A) and offsite exposure to the west and north.

Some wells may not yield representative water samples which may be due to biofouling or siltation.

Concentrations of arsenic and VOCs remain above cleanup goals.

Institutional Controls not finalized, accompanied by sustained residential development pressure near the Site.

Recommendations and Follow-up Actions:

Potential residual source areas in soil and/or weathered bedrock. May affect offsite and onsite groundwater quality, and potentially impact surface water quality in Brook A where only limited sampling has occurred.

- Investigate Suspected Residual Contaminant Source Areas.
- Investigate soil and weathered bedrock near high arsenic and VOC detections.
- Remove soil if necessary.
- If SBA area wells are sound, conduct a geophysical survey to assess boundary of potential residual source area.

Insufficient sampling to determine seasonal groundwater and surface water contaminant variation and to assess potential mobilization of contaminants onsite (near Brook A) and offsite exposure to the west and north.

- Revise Groundwater and Surface Water Sampling Plan. Use low flow sampling for all wells unless there is a well-specific problem which cannot be overcome.
- Sample domestic wells north and west of the site during high and low groundwater conditions.
- Re-institute seasonal surface water and groundwater monitoring during high and low groundwater conditions.
- Evaluate contaminant pathways and determine if new monitoring wells are needed at the Site boundaries.
- Locate groundwater to surface water discharge areas and evaluate the concentration of groundwater contaminants entering the brook.
- Optimize Site/residential well sampling frequency.
- Evaluate the need for well head treatment.

Some wells may not yield representative water samples which may be due to biofouling or siltation

- Evaluate well conditions.
- Physically and hydraulically inspect/re-develop all monitoring wells.
- Remove and/or replace poorly performing monitoring wells.

Concentrations of arsenic and VOCs remain above cleanup goals

- Collect additional arsenic and VOC data.
- Include arsenic as analyte for four rounds of surface water, residential and Site groundwater monitoring well networks; optimize each successive round based on the results.
- Sample some residential wells for full suite of contaminants vs. COCs only.
- Collect additional natural attenuation (NA) parameters.
- Apply analytical techniques to refine estimates of cleanup times.

Institutional Controls not finalized, accompanied by sustained residential development pressure near the Site.

- Re-Assess Institutional Controls.
- Finalize Institutional Controls.

Protectiveness Statement(s)

The remedy is no longer protective because of persistence and increases in some COC concentrations in groundwater from several monitoring wells since the last FYR. Several issues raised during this review have led to recommendations to improve monitoring and evaluation of contamination. Analysis indicates that natural attenuation has not occurred uniformly across the Site over the last five or more years and that the estimated cleanup times as specified in the ROD have not been achieved. Also, the cleanup objective for arsenic in groundwater was lowered from 50 µg/L to 10 µg/L, though there are no known exposures occurring due to any of the Site-related COCs for groundwater. Residential development around the site continues with increasing pressures on the groundwater resources that may create the likelihood of exposure.

The immediate threats from soil were addressed by completed remedial activities. However, additional investigation of contaminants in soil and/or weathered bedrock, additional groundwater and surface water sampling, evaluation of well conditions to include inspection/replacement/repair of wells, evaluation of well head treatment and finalization of institutional controls are needed to fully assess and ensure protectiveness.

Other Comments:

1.0 INTRODUCTION

The purpose of this FYR is to determine if the remedy at the Mottolo Pig Farm Site is protective of human health and the environment. Under an Inter-Agency Agreement and in accordance with an approved work plan dated October 2007, the United State Environmental Protection Agency (EPA) Region 1, New England, directed the U.S. Army Corps of Engineers, New England District (USACE) to prepare this third FYR of the Mottolo Pig Farm Superfund Site (Site) in Raymond, New Hampshire (Figure 1). This FYR is prepared pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

CERCLA §121(c), as amended, states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The NCP part 300.430(f) (4) (ii) of the Code of Federal Regulations (CFR) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This is the third FYR for the Mottolo Pig Farm Site and is required because the selected remedy for Site contaminants resulted in contaminants remaining at concentrations exceeding those associated with unrestricted exposure to Site media. The trigger for this policy review was the last FYR completed September 10, 2003 (USEPA, 2003). The findings and conclusions of this review are documented in this report. The report also identifies issues found during the FYR process and offers recommendations to address those issues.

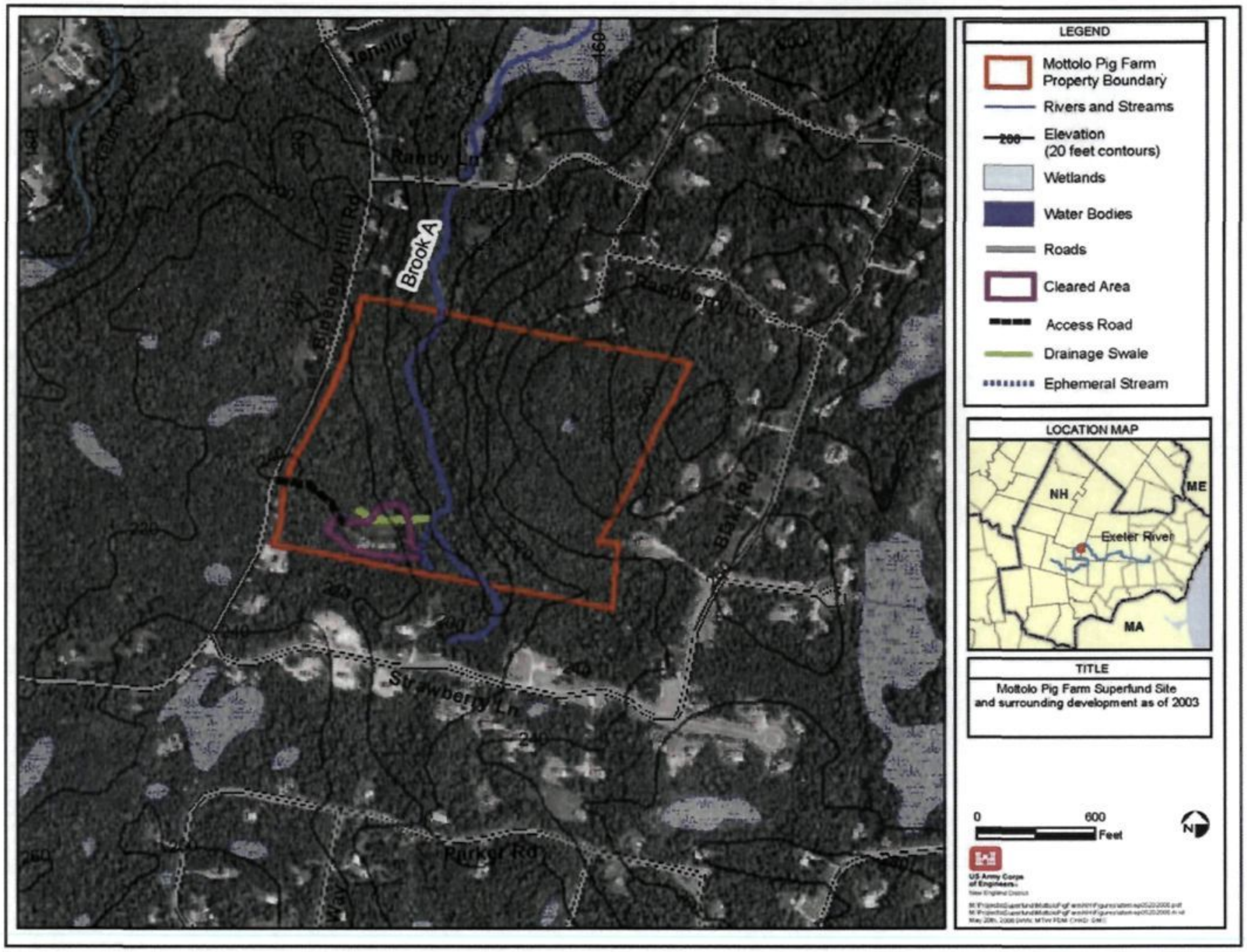

Figure 1. Location map for Mottolo Pig Farm Superfund Site, Raymond, New Hampshire.

2.0 SITE CHRONOLOGY

The chronology of the Site, including all significant Site events and dates is included in Table 1 (USEPA, 2008a, 2003, NHDES, 1992-2008).

Table 1. Chronology of Site events.

Date	Event
1960s – 1975	Use of the site for swine husbandry
1975 - 1979	Disposal of wastes
1979	Discovery of the problem
1980-1981	Excavation, staging and removal of soil and drums
July 22, 1987	Final listing on NPL
March 29, 1991	Remedial Investigation/Feasibility Study (RI/FS) complete
March 29, 1991	ROD signature
20 May 1993	Remedial Design completed
June 24, 1993	Construction start
September 30, 1993	Construction completion
December, 1996	Removal of soil vapor extraction system
Spring, 1997	Installation of liner to minimize water infiltration and re-grading of site
June 28, 1998	Remedial Action completed
September 11, 1998	First Five-Year Review report
December 1, 1999	Potentially Responsible Party (PRP) consent decree signed
Summer, 2000	Removal of chain link fence, vandal-proofing of monitoring wells and de-commissioning of unused wells
Fall, 2001	Removal of interceptor trench and liner
Early 2003	Surface water sampling on Brook A discontinued
September 10, 2003	Second Five-Year Review report. Surface water sampling terminated.
June, 2003	First Strawberry Lane residential well sampled. Quarterly sampling for five residences on Strawberry Lane began in March 2004
January 18, 2008	PRP issued groundwater management zone permit by NHDES
August 26, 2008	Third Five-Year Review report

3.0 BACKGROUND

3.1 Physical Characteristics

The Site is on Blueberry Hill Road in Raymond, New Hampshire (Figure 1). The Mottolo property includes approximately fifty acres of primarily undeveloped wooded land, roughly divided in half by a small brook and associated wetlands. About two acres in the southwest part of the property remain cleared near the former piggery and the hazardous-waste-removal operations (Figure 2). Site structures in and near the cleared area include two concrete pads for the former piggery building, a shed housing a boiler, and a dug well of unknown depth and construction. The Site is surrounded by private residences each with its own water supply well.

The Site is within the Exeter River drainage basin. The Exeter River is approximately 1,500 feet west of the Site boundary at its closest point (Figure 1). Brook A is a perennial stream that flows north across the Mottolo Property, draining approximately 285 acres at its confluence with the Exeter River (north of the map area on Figures 1 and 2). An ephemeral stream drains approximately four acres of the undeveloped woodland between the cleared portion of the Site and Blueberry Hill Road. Runoff in the ephemeral stream flows south to north into Brook A. A drainage swale crosses the site from west to east, just north of the Former Drum Disposal Area (FDDA), and also discharges to Brook A.

The geology of the Site is generally characterized by glacial till and outwash deposits (overburden) overlying bedrock. The bedrock consists of Berwick Formation schists intruded by Devonian-age granites and a few pegmatite dikes (Peters and others, 2006, Freedman, 1950, 2002, Utsunomiya and others, 2003). These lithologies are bounded three miles to the northwest by the Flint Hill Fault, and nine miles to the southeast by Devonian-age plutons (Hussey, 1985). Both structural margins trend northeast, with secondary structural trends present throughout the region. The weathered bedrock thickness is highly variable, based on the geotechnical evaluation of the rock core. No pyrite-type minerals were observed in any of the rock core from the Site (Balsam Environmental Consultants, Inc., 1990). Analysis of various remote sensing data identified two dominant lineament sets in the area surrounding the site which may be near vertical fracture zones or fracture sets (Ferguson and others, 1997) (Figure 3). The data were analyzed by the United States Geological Survey (USGS) to support future groundwater exploration and management, and represent potential bedrock groundwater flow pathways with trends following many secondary bedrock structures.

The onsite overburden deposits are primarily fine to coarse sand with pockets of gravel, that generally range from zero to twenty feet thick with the thickest deposits found at the base of the FDDA, south of the drainage swale (Figure 2). Overburden deposits west of the former Piggery Building are thinner and more heterogeneous, and bedrock crops out in several places. Soils were removed during installation and subsequent removal of the remediation system, and backfilled with non-native fill materials.

An east-west trending groundwater divide in the overburden passes between the suspected and confirmed source areas during periods of high groundwater levels, which are typically in the spring (Figure 2). This divide may shift position with changes in recharge. Groundwater discharges to Brook A at the base of the drainage swale in the spring, and likely discharges further north during fall or periods of low groundwater levels. Water levels in Site wells typically fluctuate seasonally by 6 to 10 feet.

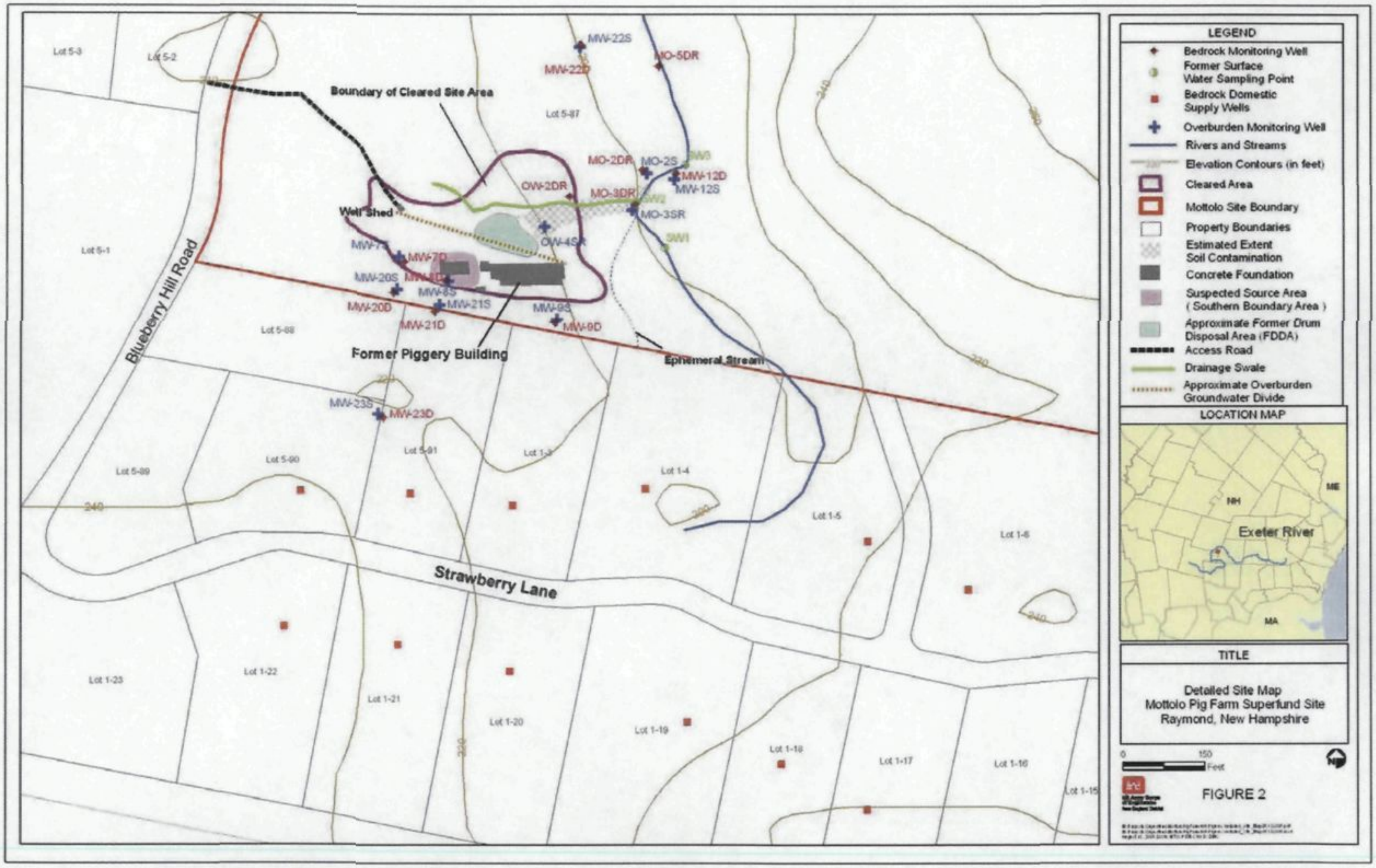

Figure 2. Locations of Site features, monitoring wells, former surface-water sampling stations, and domestic wells south of the Mottolo Superfund Site, Raymond, New Hampshire.

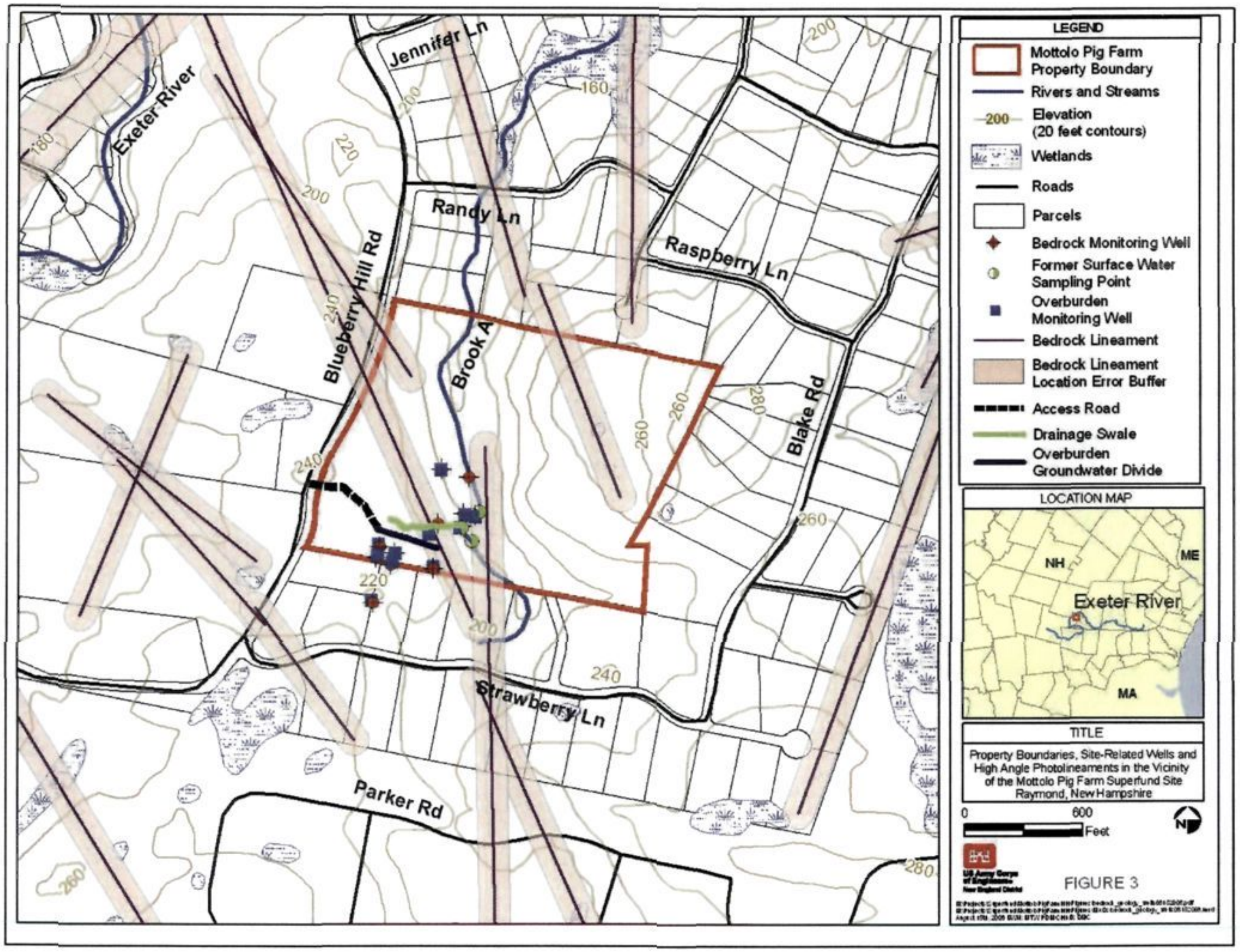

Figure 3. Physiographic features, mapped lineaments, and the monitoring network, Mottolo Pig Farm Superfund Site, Raymond, New Hampshire (NHDES, 2007, Ferguson and others, 1997).

3.2 Land and Resource Use

The area around the Site is largely wooded, but single-family residences are present on all sides (Figure 1). The closest residence is approximately 300 feet south of the Site Boundary, and 500 feet south of the remediated area (Figure 2). Homes on Strawberry Lane were constructed beginning about 2000. The newest completed development is west on Blueberry Road. A new residential area is being cleared and graded for house construction northwest of the Site. All homes near the Site are served by private bedrock wells of various depths. No public water supply is available.

3.3 History of Contamination

The Site was initially a pig farm (Balsam Environmental Consultants, Inc. 1990). From 1975 through 1979, the property owner disposed of approximately 1,600 fifty-five gallon drums and five gallon pails containing wastes into an approximately ¾-acre depression located immediately north of the FDDA. In addition, at least one tanker of liquid wastes was emptied in the same area. After dumping the containers from the back of a truck, a bulldozer was used to cover them with fill. Evidence of leaking drums was reported to state officials in 1979.

The vertical extent of soil contamination in the FDDA typically extended from approximately two to four feet below ground surface to the bedrock surface, with the most contaminated soil being found near the water table. The saturated volume of contaminated soil varied seasonally with groundwater fluctuations of as much as five feet. The source area responsible for VOCs in the groundwater in the southern boundary area (SBA) was inferred to be overburden soils near the concrete pads west of the Piggery Building and near the bedrock-overburden contact. A description of likely sources can be found in the Remedial Investigation and Feasibility Study (RI/FS) reports (Balsam Environmental Consultants, Inc., 1990, 1991). One such source for arsenic might be piggery-related arsenicals from animal husbandry operations used at the Site. A common piggery arsenical was roxarsone, which is mostly excreted and thought to breakdown into inorganic arsenic.

3.4 Initial Response

The Site was discovered in April 1979. Preliminary investigations conducted by the New Hampshire Water Supply and Pollution Control Commission (now the Department of Environmental Services – NHDES) indicated that disposal of chemicals in the confirmed source area contaminated soils, surface water, and groundwater with volatile organic compounds (VOCs). Among the VOCs found were methylene chloride, 1,1,1-trichloroethane, 1,2 dichloroethene, vinyl chloride, trichloroethylene, and tetrachloroethylene. Aromatics, including ethyl benzene, toluene and xylenes were also identified, as well as acetone. Arsenic is present in groundwater and is the primary inorganic compound of concern at this Site.

In 1980, under authority of the Clean Water Act, the EPA used emergency funds to excavate and store drums onsite. From 1981 to 1982, the EPA performed a removal action involving the excavation, staging, testing, onsite storage and offsite disposal of approximately 1,600 containers of wastes from the FDDA, and some contaminated soil (Figure 4) (USEPA, 1991). This removal action was completed before the RI/FS was initiated in the mid 1980s.

3.5 Basis for Taking Action

Contaminants of Concern (COCs) selected for evaluation of Site risks by media included:

Groundwater: arsenic, 1,1 dichloroethane (1,1 DCA), 1,2 dichloroethene (1,2 DCE (total), ethylbenzene, tetrahydrofuran (THF), 1,1,1 trichloroethane (TCA), toluene, trichloroethene (TCE) and vinyl chloride (VC)

Surface Water: 1,1 DCA, 1,2 DCE (total)

Sediment: 1,1 DCA, (1,1,1 TCA)

Soil: ethylbenzene, toluene, xylene

The ten COCs were selected to assess Site-related hazards based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment. Several pathways of hypothetical exposure were identified to assess exposures based on the present uses, potential future uses and location of the Site.

For contaminated groundwater, future residential use of the Site was assumed and exposure scenarios were developed for both bedrock and overburden aquifers. For soils, incidental ingestion and dermal contact scenarios were developed for current and potential future use of the Site. Based on the findings in the Baseline Risk Assessment, the EPA concluded that the risk posed by the future ingestion of groundwater from wells installed within the FDDA exceeds the acceptable risk range with principal contributors being arsenic, VC and TCE. The Hazard Index (HI) exceeds unity for future ingestion of groundwater from the FDDA with the HI of 7 for 1, 2 DCE (total) and a HI of 3 for THF.

4.0 REMEDIAL ACTIONS

4.1 Remedy Selection

The remedy selected for the Mottolo Site by the EPA after the emergency removal (Figure 4) and preparation of the RI/FS was in-situ vacuum extraction (now called soil vapor extraction (SVE)) with natural attenuation (NA) for contaminated groundwater and surface water (Balsam Environmental Consultants, Inc., 1991, 1990). A groundwater interceptor trench was constructed to dewater the FDDA soils. Vacuum extraction wells were installed in two areas and the wells were connected to a treatment system located on the Piggery Building Pad. The remedial action objectives identified in the Record of Decision (ROD) issued March 29, 1991, are:

- To eliminate or minimize the threat posed to the public health, welfare, and environment by the current extent of contamination of groundwater and soils;
- To eliminate or minimize the migration of contaminants from the soils into the groundwater; and
- To meet federal and state Applicable or Relevant and Appropriate Requirements (ARARs).

The ROD identified SVE for remediation of the Site soils, natural attenuation for remediation of Site groundwater and surface water, and institutional controls to prevent consumption of contaminated groundwater until groundwater cleanup levels were attained.

4.2 Remedy Implementation

The Site was divided into the FDDA and the Southern Boundary Area (SBA). EPA contracted with Metcalf & Eddy to develop the remedial design and implement the remedial action for soils. Work was divided into two phases: the first phase, completed in 1992, included design and installation of a site security fence, a groundwater interceptor trench, and a distribution lateral around the FDDA to lower the groundwater level so that SVE could be effective down to the bedrock surface. The second phase included pilot testing, design, installation, and operation of the SVE system in both the FDDA and SBA.

Figure 4. Photo of drum removal during 1981 excavation (USEPA, 2008).

Figure 5. Soil removal and liner installation in 1997 (USEPA, 2008).

A Preliminary Close-Out Report signed on September 30, 1993, indicated that construction of the remedy was complete and that the SVE was operational and functional.

Confirmatory vapor sampling was conducted to determine when the vacuum extraction system could be shut off. In the fall of 1996, after three years of operation, soil samples were collected and analyzed for VOCs using a field gas chromatograph (GC) (Metcalf and Eddy, 1997). Leachate samples were collected and analyzed at a fixed laboratory using USEPA Method 524.2. No soil or groundwater contamination was found above soil cleanup levels in any of the samples.

Based on results for soil and leachate samples, the extraction system was turned off in late 1996. All aboveground components of the system were removed from the treated area in December 1996, and a liner was installed to minimize infiltration of water in spring 1997 (Figure 5). The interceptor trench and liner were removed from the FDDA in December 2001 and the area was re-graded and seeded with grass.

Annual sampling to assess NA is performed in late spring for the Site network of monitoring wells (Figure 2). Well construction and water-level data are presented in Table 2. Sampling for VOCs began in June 2003 at selected residences on Strawberry Lane.

Table 2. Well data and water-level measurements 1997-2007 (NHDES, 2007d).

Well ID	Well Type	Well Depth NEW 2001 (ft)	Elevation of Riser NEW 2001 (ft)	Well Depth OLD 2000 (ft)	Elevation of Riser OLD 2000 (ft)	Dia. (Inch-es)	Screen Length (ft)	Depth to Water (ft)	Depth to Water (ft)	Depth to Water (ft)	Depth to Water (ft)	Depth to Water (ft)	Depth to Water (ft)	Depth to Water (ft)	Depth to Water at New Depths (ft)	Depth to Water at New Depths (ft)	Depth to Water at New Depths (ft)	Depth to Water at New Depths (ft)	Depth to Water at New Depths (ft)	Depth to Water at New Depths (ft)	Depth to Water at New Depths (ft)	*Notes
								4/9/1997	10/28/1997	4/1/1998	9/9/1998	5/10/1999	5/25/1999	4/24/2000	5/23/2001	4/29/2002	6/5/2003	5/24/2004	5/19/2005	6/14/2006	5/22/2007	
MW-7S	Over-burden	5.52	228.08	6.7	229.8	2	2	4.1	Dry	5.14	Dry	6.43	6.77	2.57	Dry	2.95	4.14	2.7	4.46	2.99	3.15	VOCs
MW-7D	Bedrock	26.29	228.32	28.1	229.9	6	11	5.68	13.58	5.53	11.99	7.58	8.03	5.81	5.89	4.88	4.86	4.83	4.21	3.72	4.9	WL, Steel, no riser
MW-8S	Over-burden	18.12	230.15	19.5	231.47	2	10	6.12	14.8	6.53	13.56	8.49	8.93	4.91	7.76	5.95	6.3	5.93	6.35	4.5	5.07	VOCs
MW-8D	Bedrock	32.84	230.25	34.9	232.13	6	11	12.35	12.38	11.27	11.15	11.25	11.29	11.53	8.79	7.9	7.59	21.94	17.48	14.17	12.85	WL, Steel, no riser
MW-9S	Over-burden	3.89	218.17	7.5	221.32	2	2	6.17	Dry	6.28	Dry	**	Dry	4.57	Dry	3.26	Dry	2.99	3.94	2.44	2.97	VOCs
MW-9D	Bedrock	16.96	218.64	19.8	221.47	4	10	6.07	16.53	6.23	14.54	**	8.11	4.41	5.48	3.6	3.45	3.23	4.28	2.83	3.68	WL, Inside steel
MW-12S	Over-burden	12.36	188.27	15.5	191.24	2	6	6	7.32	5.97	7.38	**	6.01	5.46	3.55	2.78	3.05	2.49	7.25	2.87	2.82	VOCs
MW-12D	Bedrock	28.36	186.91	31.2	189.63	3	10	Flowing	1.58	Flowing	1.03	**	Flowing	Flowing	Flowing	Flowing	Flowing	Flowing	Flowing	Flowing	Flowing	VOCs, Inside steel
MW-20S	Over-burden	10.65	223.38	11.2	226.57	2	5	4.37	10.3	4.61	9.19	5.16	5.04	3.83	2.33	1.16	1.4	0.84	1.51	1.16	1.17	VOCs
MW-20D	Bedrock	45.14	223.31	45.9	225.27	2	20	2.95	10.72	3.92	10.33	5.95	5.93	3.65	5.31	2.68	3.45	3.08	3.07	3.26	4.11	VOCs
MW-21S	Over-burden	7.72	228.46	10.7	231.48	2	3	6.05	Dry	6.26	Dry	8.85	12.49	4.34	6.3	4.3	4.8	3.86	4.61	3.13	3.27	VOCs
MW-21D	Bedrock	40.47	228.17	41.4	231.72	2	20	9.29	17.02	10.3	16.91	12.5	9.56	9.99	10.38	7.62	8.88	8.41	8	8.5	8.95	VOCs
MW-22S	Over-burden	11.39	185.05	12	?***	2	5	2.7	8.93	2.4	7.5	**	2.91	2.02	1.9	0.2	0.33	Flowing	0.41	Flowing	Flowing	VOCs
MW-22D	Bedrock	33.84	184.79	34.5	?***	2	15	2.25	9.38	2.96	7.97	**	3.44	2.61	1.69	0.25	0.17	Flowing	0.23	Flowing	Flowing	VOCs
MW-23S	Over-burden	11.39	224.02	12	?***	2	5	5.43	10.78	5.76	9.72	**	5.85	4.82	3.84	3.13	3.35	2.68	3.3	2.9	2.93	VOCs
MW-23D	Bedrock	31.6	224	32	?***	2	15	5.34	10.88	5.74	9.83	**	5.9	4.68	3.83	3.1	3.29	2.5	3.25	2.72	2.75	VOCs
MO-2S	Over-burden	8.61	186.5	10.7	188.65	1.5	5	2.1	3.22	2.21	3.5	2.6	2.38	1.8	0.43	Flowing	Flowing	Flowing	Flowing	Flowing	Flowing	VOCs -As
MO-2DR	Bedrock	26.13	188.32	28.1	190.11	3	10.9	3.17	4.42	2.49	3.47	3.2	3.11	1.6	1.73	0.72	0.67	0.53	0.86	Flowing	0.95	VOC-As, Inside steel
MO-3SR	Over-burden	9.27	187.37	11.4	189.29	2	2.5	1.37	2.75	1.43	2.91	1.76	1.71	1.33	Flowing	Flowing	Flowing	Flowing	Flowing	Flowing	Flowing	VOCs -As
MO-3DR	Bedrock	23.95	188.07	27.3	191.03	4	10	1.18	3.52	1.4	4.18	2.33	2.33	1.34	Flowing	Flowing	Flowing	Flowing	Flowing	Flowing	Flowing	VOC-As, Inside steel
MO-5DR	Bedrock	25.5	184.25	25.5	184.17	3	10.6	2.87	3.95	2.76	4.35	**	2.97	2.56	3.07	2.74	2.73	2.59	2.79	2.66	2.64	VOCs
OW-2DR	Bedrock	34.88	209.27	37.3	211.6	2	10	6.6	11	5.99	9.82	7.56	7.95	3.24	4.85	1	1.44	0.2	1.7	0.26	0.58	VOCs -As
OW-4SR	Over-burden	12.66	218.88	13.3	219.3	2	5	8.53	12.69	6.11	11.19	9.11	9.68	2.97	7.33	3.17	3.66	2.65	3.66	1.21	2.34	VOCs -As

Note: After the April 2000 sampling round the height of the protective casing and risers on all wells, except MO-5DR, were cut to below ground surface and road boxes were installed.

?*** The old elevations of risers for these four wells cannot be located, not sure if they were ever surveyed. Metcalf & Eddy is currently looking into it.

* All water levels measured from PVC unless otherwise noted.

** This water level was lost. Another complete round of water levels was collected on May 25, 1999.

WL = Water levels only VOCs = Honda and Bailers VOCs -As = VOCs + Arsenic using Low Flow (or variation thereof)

12.49 Not possible due to well depth

4.3 System Operation/Operation and Maintenance

Fencing and Institutional Controls (ICs) were to be implemented to restrict the use of contaminated groundwater and prevent disturbance of ongoing remedial actions. Institutional controls include the establishment of a Groundwater Management Zone (GMZ) on the Mottolo property, where regulatory approval would be required to effect any changes to existing groundwater use, such as installing new extraction wells, etc. The GMZ permit was approved by NHDES in January, 2008 but has not yet been recorded on the Mottolo property.

There were numerous incidents of vandalism while the Site fence was in place. The fencing was removed in the year 2000 and incidents of vandalism have decreased to near zero since.

Maintenance primarily involves taking groundwater samples and ensuring the integrity of the monitoring network so that representative samples can be obtained. There is also some, occasional security gate maintenance. NHDES personnel had indicated problems with some wells (primarily drainage issues) and took corrective actions. Annual operations and maintenance costs are shown in Table 3.

Table 3. Estimated annual system operations and maintenance costs (NHDES, personal communication).

Dates		Monitoring	Maintenance	Total Cost
From	To	$	$	$
1 Jan 2003	31 Dec 2003	30,000	2,000	32,000
1 Jan 2004	31 Dec 2004	30,000	2,000	32,000
1 Jan 2005	31 Dec 2005	30,000	2,000	32,000
1 Jan 2006	31 Dec 2006	30,000	2,000	32,000
1 Jan 2007	31 Dec 2007	30,000	2,000	32,000

The ROD cleanup goals for groundwater, developed in response to the first remedial action objective, along with the maximum levels of contaminants found in monitoring wells since the last FYR (2003), and the most recent results are presented in Table 4. See Figure 2 for the location of the monitoring wells sampled.

Table 4. Summary of 2003 and 2007 annual groundwater sampling results, Mottolo Pig Farm Superfund Site, Raymond, New Hampshire. [ROD cleanup goals, and AGQS criteria with exceedences in bold (NHDES, 2003a, 2007d)]

2007 Annual Sampling Summary	COC	AGQS (µg/l)	ROD ICL (µg/l)	MO-2S	MO-2DR	MO-3SR	MO-3DR	OW-2DR	OW-4SR	MO-5DR	MW-7S	MW-7D	MW-8S	MW-8D	MW-9S	MW-9D	MW-12S	MW-12D	MW-20S	MW-20D	MW-21S	MW-21D	MW-22S	MW-22D	MW-23S	MW-23D
VOCs of Concern																										
1,1-Dichloroethane	Y	81	81	<2.0	<2.0	10	8.4	7.7	12	2.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Cis-1,2-Dichloroethene	Y	70	n/a	<2.0	3.1	44	**182**	64	<2.0	10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	11	<2.0	<2.0	<2.0	<2.0	<2.0	14	<2.0	<2.0
Trans-1,2-Dichloroethene	Y	100	n/a	<2.0	<2.0	3.4	36	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-Dichloroethene, (Total)	Y	n/a	70	<2.0	3.1	47.4	**218**	64	<2. 0	10	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	11	<2.0	<2.0	<2.0	<2.0	<2.0	14	<2.0	<2.0
Tetrahydrofuran (THF)	Y	154	700	<10	<10	<10	76	<10	<10	16	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Trichloroethene	Y	5	5	<2.0	3.2	**29**	**58**	**39**	<2.0	**9.1**	<2.0	<2.0	3	<2.0	<2.0	<2.0	<2.0	3.6	<2.0	<2.0	<2.0	4.2	<2.0	**15**	<2.0	<2.0
Vinyl Chloride	Y	2	2	<2.0	<2.0	**22**	**25**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,1-Trichloroethane	Y	200	200	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Ethylbenzene	Y	700	700	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Toluene	Y	1,000	1,000	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total VOCs of Concern				ND	6.3	108.4	385.4	110.7	12	37.2	ND	ND	3	ND	ND	ND	ND	14.6	ND	ND	ND	4.2	ND	29	ND	ND
Additional COCs																										
Acetone	N	700	n/a	<10	<10	<10	<20	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	33	<10	<10	<10	<10
Chloroethane	N	n/a	n/a	<2.0	<2.0	4	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic	Y	10**	50	**244.7**	**20.4**	**939.5**	**112.1**	**67.2**	ND	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

2003 Annual Sampling Summary	COC	AGQS (µg/l)	ROD ICL (µg/l)	MO-2S	MO-2DR	MO-3SR	MO-3DR	OW-2DR	OW-4SR	MO-5DR	MW-7S	MW-7D	MW-8S	MW-8D	MW-9S	MW-9D	MW-12S	MW-12D	MW-20S	MW-20D	MW-21S	MW-21D	MW-22S	MW-22D	MW-23S	MW-23D
VOCs of Concern																										
1,1-Dichloroethane	Y	81	81	60	33	36	16	**120**	5.1	3.1	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	3.2	<2.0	<2.0
Cis-1,2-Dichloroethene	Y	70	n/a	14	11	20	**208**	**358**	<2.0	6.6	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	9.9	<2.0	<2.0	<2.0	<2.0	<2.0	11	<2.0	<2.0
Trans-1,2-Dichloroethene	Y	100	n/a	<2.0	<2.0	3.3	42	7.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,2-Dichloroethene, (Total)	Y	n/a	70	14	11	23.3	**250**	**365.2**	<2.0	6.6	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	9.9	<2.0	<2.0	<2.0	<2.0	<2.0	11	<2.0	<2.0
Tetrahydrofuran (THF)	Y	154	700	50	60	24	109	**192**	<10	26	<10	<10	<10	<10		<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Trichloroethene	Y	5	5	**8.6**	3.6	**12**	**89**	**109**	<2.0	<2.0	<2.0	<2.0	**57**	<2.0		<2.0	<2.0	4.4	<2.0	<2.0	<2.0	**34**	<2.0	4.1	<2.0	<2.0
Vinyl Chloride	Y	2	2	**5**	**2.7**	**10**	**44**	**37**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
1,1,1-Trichloroethane	Y	200	200	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Ethylbenzene	Y	700	700	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Toluene	Y	1,000	1,000	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total VOCs of Concern				137.6	110.3	105.3	508	823.2	5.1	35.7	0	0	57	ND		ND	ND	14.3	ND	ND	ND	34	ND	18.3	ND	ND
Additional COCs																										
Acetone	N	700	n/a	<10	<10	<10	<20	<10	<10	<10	<10	<10	<10	<10		<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chloroethane	N	n/a	n/a	6.8	2.1	<2.0	<2.0	9.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0		<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Arsenic	Y	10**	50	**347.3**	4.5	**782**	**73.5**	**255.6**	< 1	n/a	n/a	n/a	n/a	n/a		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Notes:

µg/l, micrograms per liter. ** The AGQS (Ambient Groundwater Quality Standard) for arsenic was changed from 50 to 10 µg/l in 2002; n/a, not analyzed; ICL, interim cleanup level); COC, chemical of concern.

Sampling procedures in 2003 (NHDES, written commun., 2008)

a. The following wells were purged with a centrifugal pump and/or bailer and sampled with a bailer: MW-7S, MW-8S, MW-9D, MW-12S, MW-20S, MW-20D, MW-21S, MW-21D, MW-22S, MW-22D, MW-23S, MW-23D and MO-5DR.
b. MW-7D and MW-8D were purged and sampled with a Grundfos submersible pump
c. MW-9S was dry and not sampled in 2003.
d. The following four wells had artesian or artesian-like conditions: MO-2S, MO-3SR, MO-3DR and MW-12D. The standing water was evacuated from the tubing in wells MO-2S, MO-3SR and MO-3DR with a peristaltic pump, and the samples collected. A bailer was used to collect the sample from MW-12D.
e. The following wells were sampled using low flow or modified low flow methods with a peristaltic pump: MO-2DR, OW-2DR, and OW-4SR

Sampling procedures in 2007 (NHDES, written commun., 2008)

a. All samples were collected using a peristaltic pump and dedicated tubing.
b. The following wells were purged with a centrifugal pump, peristaltic pump, and/or bailer and sampled with a peristaltic pump: MW-7S, MW-8S, MW-9S, MW-9D, MW-12S, MW-20S, MW-20D, MW-21S, MW-21D, MW-23S, MW-23D and MO-5DR.
c. Five wells were sampled using the low-flow method or a variation of it: MW-7D, MW-8D, MO-2DR, OW-2DR and OW-4SR
d. The six remaining wells were under artesian or similar conditions. Samples were collected after evacuating the standing water from the tubing. MO-2S, MO-3SR, MO-3DR, MW-12D, MW-22S and MW-22D

5.0 PROGRESS SINCE THE LAST FIVE-YEAR REVIEW

5.1 Protectiveness Statements from Last Review

The last FYR contained one Protectiveness Statement: "Because the remedial actions being implemented throughout the Mottolo Pig Farm Superfund Site are protective, the Site is protective of human health and the environment" (USEPA, 2003).

5.2 Status of Issues

The last FYR identified two issues, which are presented in Table 5, along with their status. Detailed discussions of the COC trends over time during the last five years are presented below.

Table 5. Status of issues identified in the 2003 FYR (USEPA, 2003).

Issue	Status	Results
Potential exists for development to the south to cause contamination to migrate towards residential wells.	Development south of the Site on Strawberry Lane is complete.	Monitoring to date indicates that contaminant migration to the south from domestic well pumping has not appreciably increased.
Mottolo property has potential for residential development before ground-water cleanup levels have been achieved.	Groundwater Management Zone Permit approved by NHDES in January 2008.	Analytical data indicates the property will not be suitable for development for an undetermined amount of time due to contaminant levels exceeding some MCLs by 10 to 100 times. GMZ permit approved but not yet recorded on the Mottolo property.

5.3 Status of Recommendations and Follow-Up Actions from the Last Review

The last FYR identified three recommendations and follow-up actions. These are presented in Table 6, along with their status and results where appropriate.

Table 6. Status of recommendations and follow-up actions from the 2003 FYR (USEPA, 2003).

Recommendations and Follow-up Actions	Status	Results
Monitor groundwater quarterly for residential wells near MW-21D for one year and annually thereafter for residential and monitoring wells included in the sampling program.	Selected residential wells on Strawberry Lane are monitored on a quarterly basis.	Contaminant concentrations vary with or inversely with regional groundwater levels and surface water discharge rates. Detections are generally higher in the spring than other periods.
Monitor water levels in MW-21D at least until late September 2003.	Monitoring was conducted by the USGS.	Data have been compiled but not yet published by the USGS due to a lack of funding.
Impose institutional controls on Mottolo property, as needed, if developed or sold/subdivided for residential use.	Groundwater Management Zone Permit approved by NHDES in January 2008.	Awaiting GMZ permit recordation on Mottolo property.

6.0 FIVE-YEAR REVIEW PROCESS

This third FYR was conducted in accordance with EPA's FYR guidance (USEPA, 2001). Tasks completed include review of pertinent Site-related and regional documents, trend analysis of the contaminant and water level data, interviews with parties associated or familiar with the Site, an inspection of the Site, and a review of the current status of regulatory or other relevant standards.

6.1 Administrative Components

Members of the EPA and NHDES were notified of the initiation of the FYR in November 2007. The USACE FYR Team was led by Drew Clemens, (hydrogeology) and included members from USACE with expertise in NA evaluation (Ian Osgerby), and risk assessment (Lawrence Cain). Sharon Perkins of the NHDES and Brenda Haslett of the EPA assisted in the review and represented the regulatory agencies.

From October to December 2007, the review team established the review schedule whose components included:

- Community Involvement
- Document Review
- Data Review
- Site Inspection
- Local Interviews; and
- Five-Year Report Development and Review

6.2 Community Involvement

Brenda Haslett, the EPA Project Manager, stated that there is currently no citizens review group. Interviews with various officials indicated that the public has little interest and concern about the Site but that abutters on domestic well water supply are aware of the developments and developers are following the status of water quality in residential drinking water wells. Copies of this review are being placed in the information repositories, including the Dudley-Tucker Public Library in Raymond, New Hampshire. A copy will be provided to the Town Manager, and an electronic copy will be posted on EPA's Mottolo Pig Farm web site at
(http://yosemite.epa.gov/r1/npl_pad.nsf/f52fa5c31fa8f5c885256adc0050b631/1C118677101531FE8525691F0063F6D8?OpenDocument)

and on NHDES' OneStop Environmental Site Information web site at
(http://www2.des.state.nh.us/OneStop/ORCB_Site_Results.aspx?Town=%&Address=&Name=&SiteNumber=198704094&FacilityId=&Owner=&Program Interest=CST& Project=%)

6.3 Document Review

This FYR included a review of relevant documents including ARARs provided by EPA, monitoring and residential well data provided by NHDES, regional and local data published since the RI/FS and the first two FYRs. A complete list of Site-related documents reviewed as part of this effort is listed in Section 12. Applicable cleanup standards (as listed in the 1991 Mottolo Pig Farm ROD), and toxicity values were reviewed (See Attachment A). The sampling data from the most recent (2007) and 2003 monitoring rounds are presented in Table 4.

6.4 Data Review

The RI determined that contaminants associated with the Site are present in soil (mainly within the FDDA), surface water, and groundwater (Balsam Environmental Consultants, Inc., 1990). A long-term monitoring program has been implemented to monitor the natural attenuation of Site-related contamination, as required by the ROD. Data for each media are summarized below by media and/or COC group.

6.4.1 Soils

Contaminated soils were removed from the FDDA and drainage swale area between 1980 and 1981. An SVE system was installed in this area in 1993 and operated for 3 years. After field GC testing of soil samples indicated levels below cleanup criteria, the SVE system was removed in late 1996. A liner was installed when the Site was re-graded in spring 1997. In December 2001 the liner was removed. No additional soil samples have been taken since SVE equipment removal. Limited field water quality data suggest that a caustic (high pH) source and/or Chlorinated VOCs may be present south and west of the slab in the SBA used for staging drums during drum removal operations. These data may also be an indication of poor well construction as reported in the RI (Balsam Environmental Consultants, Inc., 1990). Insufficient field water-quality data exists from collocated wells to assess the nature of these readings.

6.4.2 Groundwater

A conceptual groundwater flow model based on historical geohydrologic information is presented here to provide a basis for discussions of groundwater quality. Components of the conceptual model include geology and groundwater flow patterns. Supplemental information about groundwater conditions is included in Attachment F.

Geologic materials include till near source areas, stratified silt and sand, possibly of marine or estuarine origin at elevations below about 220 feet (Goldthwaite, 1925), and fractured crystalline rock. Groundwater levels in overburden are typically five feet or less below the land surface near the source areas, and above the land surface near Brook A when wells are sampled in the spring (Table 2). Water levels in bedrock wells near the source areas are typically several feet lower than water levels in overburden and several feet higher than water levels in overburden near Brook A. Limited water-level data for the late summer and fall indicate that water levels at the higher elevations fluctuate over a range of 10 feet or more during some years.

Conceptually, some groundwater moves downward from overburden to bedrock near the source areas. Lateral flow is dominantly eastward to Brook A through both overburden and bedrock. The main discharge area during periods of high water levels probably is along Brook A where it is closest to the source areas and possibly to the lower end of the drainage swale. Near Brook A, groundwater is expected to be an upward flow component from bedrock to overburden and from overburden to the brook. Groundwater may also flow south and southeastward toward low points in the topography in the headwaters of Brook A during periods of high groundwater levels. The low points in the topography were mapped as wetlands during the RI. This process might cause the seasonal groundwater divide that was identified near the source areas during the RI (Figure 2). During periods of low recharge, water levels decline below the level of Brook A where it is closest to the source areas, and groundwater probably discharges at lower elevations downstream to the north. Conceptually, groundwater flow patterns adjust to a more northerly direction during periods of low water levels.

Cleanup operations from 1993 to 2001, including installation of a drainage trench and liner, probably altered groundwater flow near the source areas. The trench, for example, may have been a discharge area for groundwater, at least seasonally, until its removal in 2001. Rising heads that caused flow in some monitoring wells after 2001 indicate a modification of hydrologic conditions after removal of the trench. Pumping from residential wells since 2000 may have lowered heads in water-bearing fractures, particularly during periods of high water use, and diverted some flow in bedrock southward from the source areas. The significance, if any, of photo-lineaments (Figure 3) on groundwater flow in bedrock has not been determined. A Site study of groundwater in fractured rock by the USGS was completed but not peer reviewed nor published.

Groundwater at the Site has been sampled since 1999 in accordance with New Hampshire's Hazardous Waste Remediation Bureau (HWRB) Superfund Sampling and Analysis Quality Assurance Project Plan (SAP/QAPP). The current document is the HWRB Master QAPP, Revision 1, January 2008. The Mottolo SAP was written in September 2003. However, the site is now sampled under the Mottolo Groundwater Management Permit GWP-198704094-R-001.

The monitoring well network currently (2007) consists of 23 wells screened in either bedrock or overburden. Of the 23 monitoring wells, ten had contaminant concentrations that exceeded ROD-specified cleanup levels during the current FYR period (MW-8S, MW-21D, MW-22D, MO-5DR, OW-2DR, OW-4SR, MO-2S, MO-2DR, MO-3SR and MO-3DR). The data for the 23 wells are summarized in the most recent NHDES Annual Report (NHDES, 2007d), and for this FYR in Table 4 and Figures 6 through 9. Contaminant concentration trends for monitoring wells are presented graphically with regional water-level data and major site activities in Attachment B. Figures 8 and 9 show concentrations of TCE and arsenic in wells for samples collected in May 2007.

Concentration trends for TCE and arsenic are summarized in Table 7. Trends were evaluated for the time period since 2001 when the interceptor trench was removed, as this period reflects the hydrologic system returning to pre-trench ambient conditions. Trends were determined qualitatively by visual inspection of graphs in Figures 6 and 7 and Attachment B. Declining TCE concentrations are apparent in wells MO-2S, OW-2DR, MO-3DR and MW-21D. TCE concentrations in wells MO-3SR, MW-22D, and MO-5DR have been increasing since about 2004. Little or no change is apparent in wells MO-2DR, MW-12D, and MW-8S.

The slow but steady rise in TCE concentrations at Wells MO-5DR and MW-22D may result from a delayed response to removal of the interceptor trench that served as a local sink for groundwater while operating. Removal of the trench may have caused a more northerly component of groundwater flow. Alternatively, the rise may be attributable to slow, intermittent northward migration of contaminants in response to seasonally varying groundwater flow patterns. Reductive dechlorination is limited because of unfavorable oxidation-reduction conditions (dissolved oxygen greater than 0.5 parts per million). The presence of 1,2 DCE in Well MO-3DR (182 μg/L) and vinyl chloride at Wells MO-3SR (22 μg/L) and MO-3DR (25 μg/L) in May 2007, however, indicates some reductive dechlorination in bedrock and overburden.

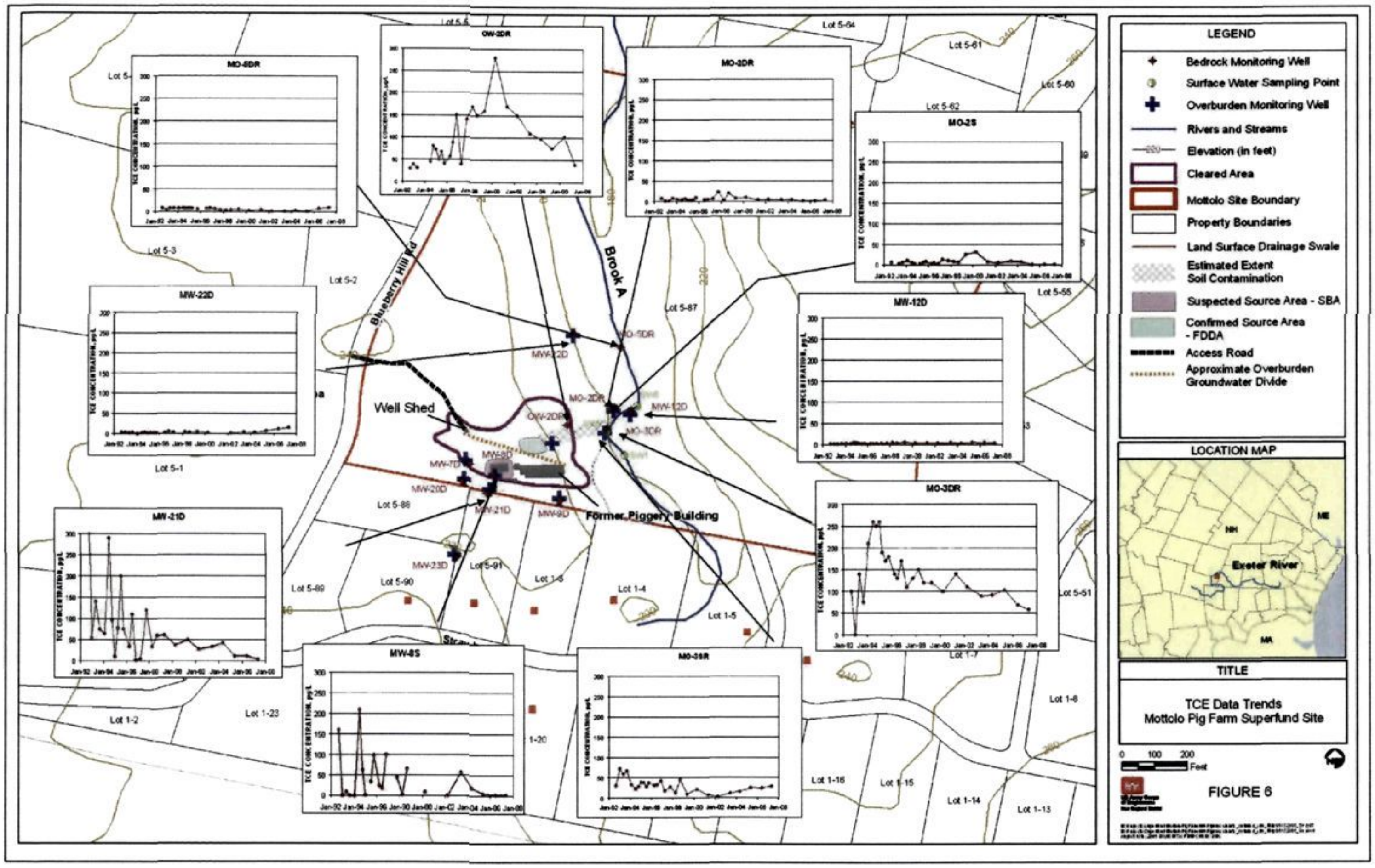

Figure 6. TCE concentration trends in groundwater, 1992-2007, Mottolo Pig Farm Superfund Site, Raymond, New Hampshire [SVE system installed in June 1993; SVE system removed in December 1996; groundwater interceptor trench removed in September 2001].

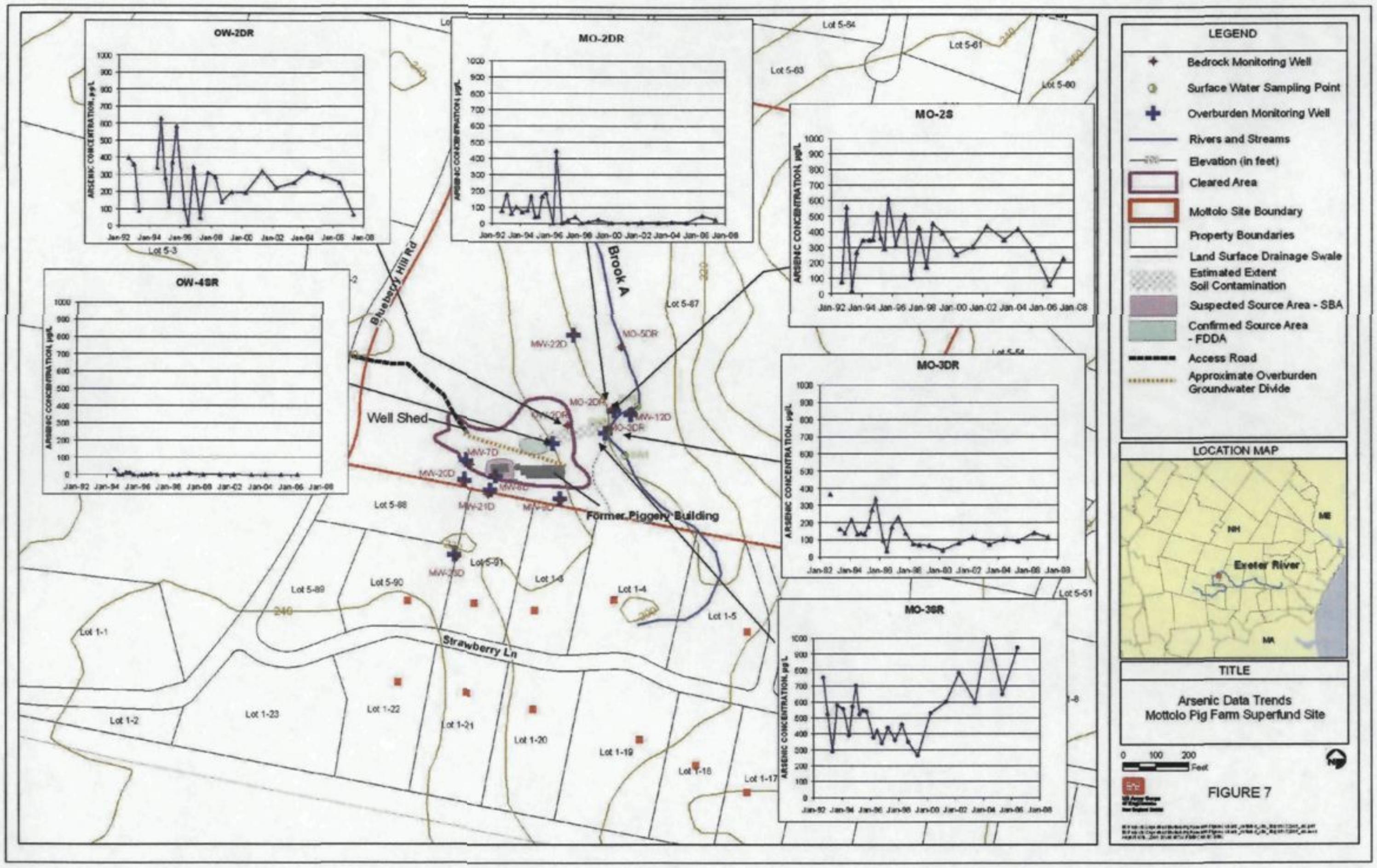

Figure 7. Arsenic concentration trends in groundwater, Mottolo Pig Farm Superfund Site. Raymond, New Hampshire [SVE system installed in June 1993; SVE system removed in December 1996; groundwater interceptor trench removed in September 2001].

Table 7. Summary of TCE and arsenic trends, 2001-2007, Mottolo Pig Farm Superfund Site. Raymond, New Hampshire.

Well	Well Type	Well Location Relative to FDDA/SBA	TCE and Arsenic Trends, 2001-07	Comments
MO-2S	Overburden	Downgradient	TCE: D As: N	TCE levels below 10 µg/L since 2000; not detected in 05, 06 and 07. Arsenic levels variable and generally above 200 µg/L; possible downward trend.
MO-3SR	Overburden	Downgradient	TCE: I As: I	TCE levels rising to above 20 µg/L since 2001. Arsenic levels strongly increasing above 600 µg/L since 2000.
OW-4SR	Overburden	Slightly downgradient from FDDA	TCE: N As: N	TCE levels below detection limit since 1995. Arsenic levels below detection limits since 2003.
MW-8S	Overburden	Source Area	TCE: N As: U	TCE variable with a high of 57 µg/L in 2003, but below 10 µg/L since 2005; possible decreasing trend. No arsenic data.
MO-2DR	Bedrock	Downgradient	TCE: N As: N	TCE levels below 10 µg/L; levels steady or declining slightly. Arsenic values vary from less than 10 µg/L to 50 µg/L; possible upward trend.
OW-2DR	Bedrock	Downgradient	TCE: D As: N	TCE levels declining since reaching a peak of 280 µg/L in 2000. Arsenic levels consistently above 200 µg/L; lower concentration in 2007.
MO-3DR	Bedrock	Downgradient	TCE: D As: N	TCE levels above 50 µg/L but steadily declining. Arsenic levels steady at about 100 µg/L since 2001.
MO-5DR	Bedrock	Downstream and downgradient	TCE: I As: U	TCE levels below 10 µg/L are generally steady or increasing slightly. No arsenic data since 1994.
MW-12D	Bedrock	Downgradient	TCE: N As: U	TCE levels steady below 5 µg/L. No arsenic data
MW-21D	Bedrock	Downgradient	TCE: D As: U	TCE levels decreasing steadily to below 10 µg/L. No arsenic data.
MW-22D	Bedrock	Downstream and nearly cross gradient	TCE: I As: U	TCE levels increasing slowly since 2000 to above 10 µg/L. No arsenic data.

SVE system installed in June 1993; SVE system removed in December 1996; groundwater interceptor trench removed in September 2001. Trends: I, increasing; D, decreasing; N, no trend or fluctuating; U, unknown. Trends were determined qualitatively by visually inspecting graphs of TCE and Arsenic concentrations shown on Figures 6 and 7 and in Attachment B.

The spatial distribution of arsenic is similar to that observed in the RI, but the values in some wells noted above have doubled since 1989. Concentrations observed in four of the six wells sampled for total arsenic exceed by 2-20 times those found in regional studies of dissolved arsenic in groundwater (Peters and others, 2006, USGS, 2003) and indicate a site-related source. The apparent rise in arsenic concentrations for Well MO-3SR (Figure 7) may relate to artesian flow that started after 2001. Concentrations are higher in water from the overburden than in water from the bedrock. For comparison, water samples collected from offsite wells during the RI had arsenic concentrations 41 µg/l or less (Balsam Environmental Consultants, Inc.). No arsenic samples have been collected from wells south of the groundwater divide (SBA) as part of the groundwater monitoring program.

The Site's RI accurately describes the overburden groundwater pathways and hydraulics between the known source areas and Brook A (Balsam Environmental Consultants, Inc., 1990), and these conclusions likely extend into the weathered bedrock. The RI combined the weathered bedrock and unweathered bedrock systems into one unit, which could be misleading, as hydraulic properties likely vary and change with depth. Weathered bedrock tends to be highly fractured and may resemble anisotropic soils. Groundwater flow within the unweathered bedrock occurs through a network of discrete fractures.

Water levels and bedrock elevation data measured during the RI indicated an overburden groundwater divide was present near the former Piggery Building, creating a northern and southern flow direction within the overburden. This divide may extend into bedrock. Since the RI, a significant part of the Site has undergone remediation, including drum and soil removal, installation and removal of an interceptor trench, SVE system and liner. These activities may have altered groundwater recharge and flow patterns.

Causes for persistent high levels of contaminants in groundwater are not known. Arsenic chemicals may have been used for piggery operations and could continue to serve as a potential source from soils and bedrock. Alternatively or in addition, arsenic that occurs naturally in bedrock and soils may have been mobilized by oxidation/reduction processes that were altered by disposal and transport of Site-related chemicals in groundwater. The wide variability of arsenic concentrations in individual wells is difficult to explain on the basis of hydrologic and geochemical processes and may relate to sampling procedures. For example, the range of variability has narrowed somewhat since standard sampling procedures were implemented in 1999. Turbid samples are likely where monitoring wells are completed in fine-grained sediments, such as near Brook A, however, the effects of turbidity on arsenic concentrations have not been evaluated.

Quarterly residential well sampling on Strawberry Lane (Figure 8), beginning in September 2003, detected TCE in wells on lots 5-91 and 1-4 at concentrations below 1.5 µg/L. Water analyses are summarized in Attachment C. Other residential wells in the area south of the site were sampled at the time the residences were occupied between September 2003 and March 2004, but no TCE was detected (NHDES, written communication 2008). Contaminant levels in the well on Lot 5-91 appear to rise and fall with seasonal recharge patterns reflected in streamflow records for the Exeter River (Figure 10), possibly indicating seasonal variations in flow patterns toward the well. Conceptually, the residential wells in bedrock could yield water from fractures connected to the Site, and pumping could cause the migration of Site-related chemicals to the wells. Unpublished water-level data collected from October 2002 through October 2003 at bedrock well MW-21D by USGS provides some insights on hydraulic connections between domestic wells and the Site.

Causes for anomalously high pH readings of around 9.0 in water from wells MW-7D and MW-8D (Attachment B) may relate to former activities near the SBA, such as treatment of piggery wastes with caustic soda. Data are insufficient to assess the cause for these high pH readings.

Some of the apparent variations in COC concentration may result from plugging of well screens and the filter pack by aquifer sediments and/or iron bacteria fouling. Clogged well screens may also cause MW-9D, MW-12S, and MW-23S to be pumped dry before the desired purge volume is achieved. Because the monitoring wells have not been re-developed since they were installed in 1988, many may not be yielding representative formation water samples. Turbid samples from wells that are not fully developed could have an effect on concentrations of contaminants, particularly arsenic.

Because the Site's monitoring wells have not been re-developed since they were installed in 1988, it is not clear how efficiently many of these wells hydraulically (and chemically) communicate with the penetrated aquifer. All of the Site's wells should be mechanically and hydraulically re-developed using USACE (1998), Kraemer and others (2006), Smith, (1995) as guidance.

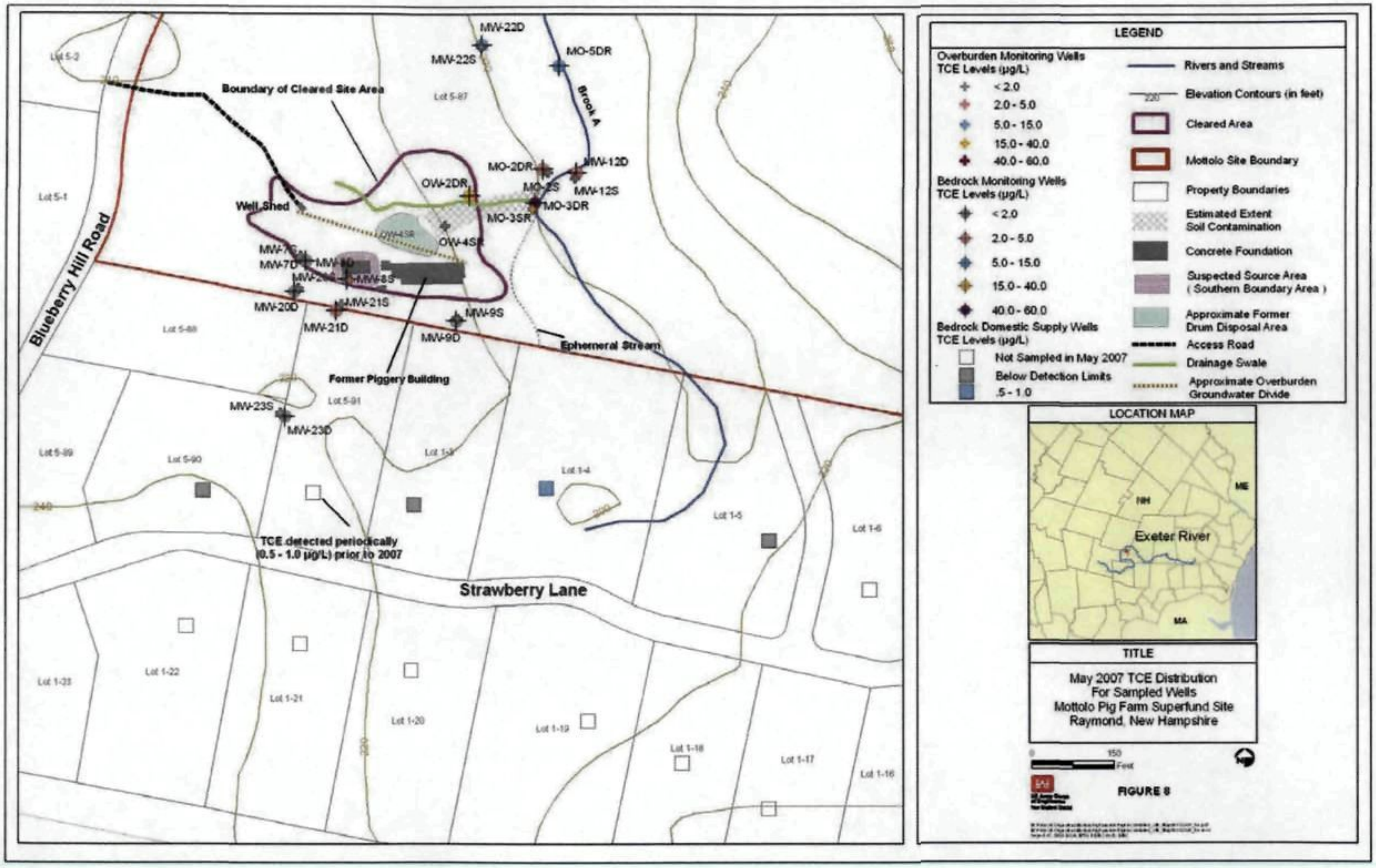

Figure 8. TCE concentrations in water from monitoring and domestic wells in May 2007, Mottolo Pig Farm Superfund Site, Raymond, New Hampshire.

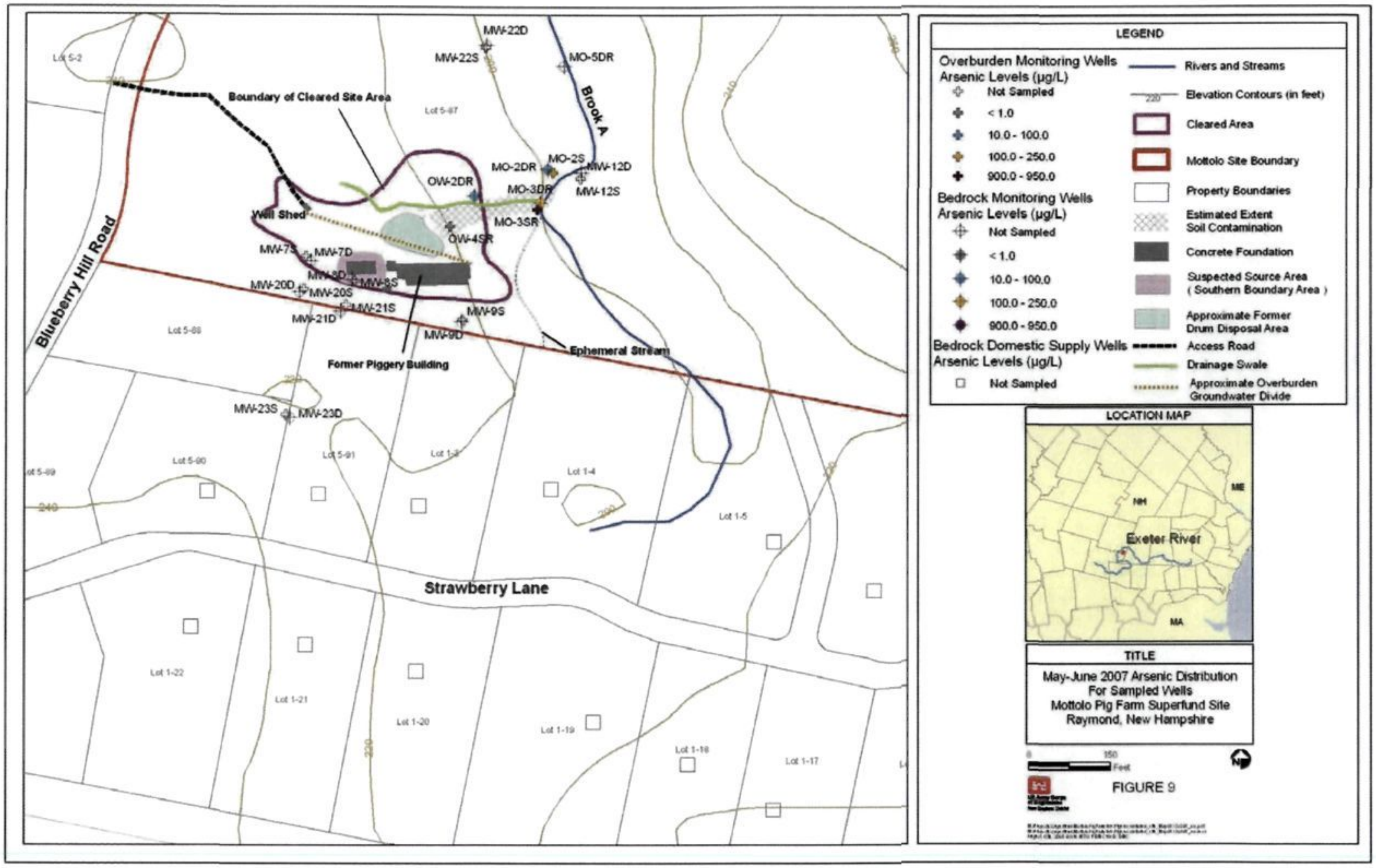

Figure 9. Arsenic concentrations in water from monitoring and domestic wells in May 2007, Mottolo Pig Farm Superfund Site, Raymond, New Hampshire.

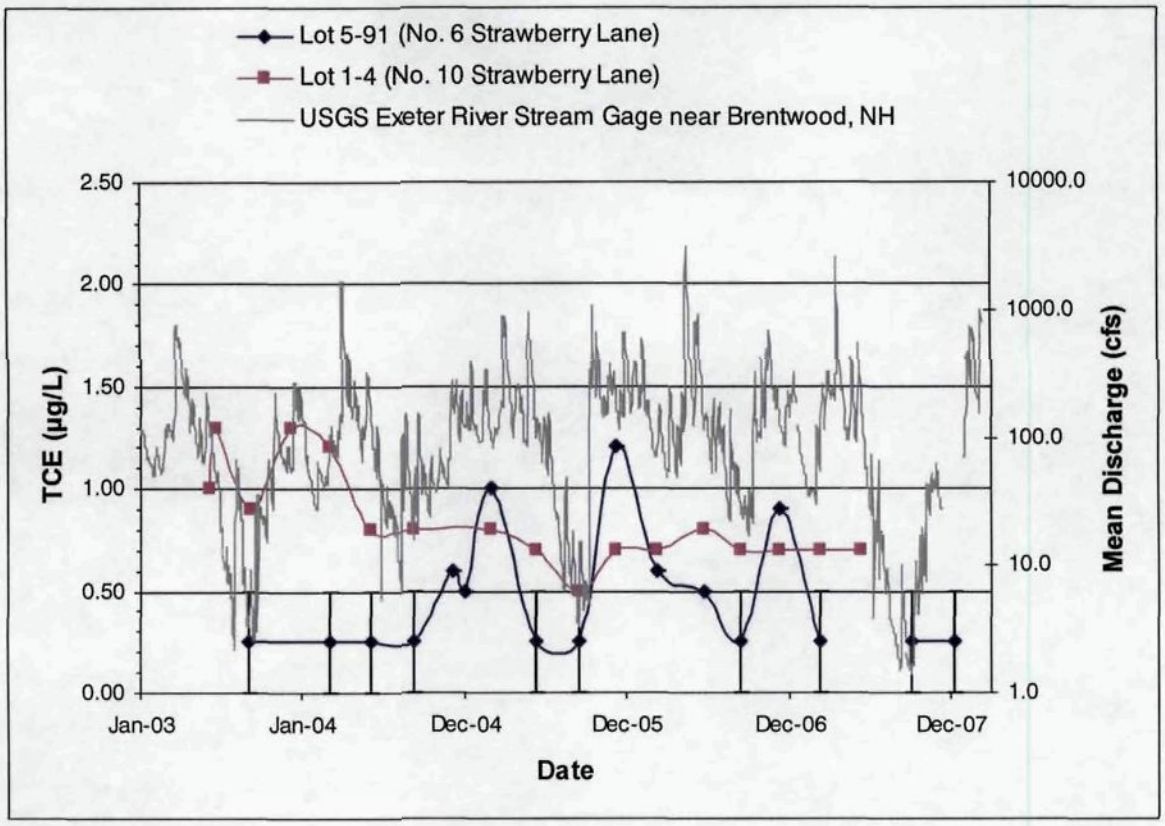

Figure 10. TCE concentrations in water from two residential wells near the Mottolo Pig Farm Superfund Site, Raymond, New Hampshire, 2003-2007 [Nondetect values plotted at 1/2 the reporting limit with error bars (NHDES 2004-2008, USGS, 2008c].

6.4.3 Surface Water

Brook A receives most of its water from groundwater discharging between SW-1 and SW-3 (Figure 2), based on two studies spanning spring, summer, and winter (Balsam Environmental Consultants, Inc., 1990). Summer through winter measurements was limited due to lack of water in Brook A, indicating that groundwater is below the streambed seasonally. Brook A changes from a gaining stream to a losing stream north of SW-03.

In accordance with the ROD, surface water sampling and analysis was previously included in the long-term monitoring program for the Site using locations selected during the RI. Surface water monitoring ceased, however, in 2004 at EPA's recommendation because contaminants were not detected. Resumption of surface water sampling in Brook A should be considered, with new locations identified after assessing seasonal groundwater discharge locations. Methods such as fiber optic temperature measurements and other field water quality testing and chemical sampling (Lane and others, 2008) may be useful for identifying groundwater-discharge reaches.

6.5 Site Inspection

A Site Inspection was conducted on 13 December 2007, which included visual inspection of the former source areas, fencing, former trench location, Site boundaries and Site groundwater monitoring wells. The Site Inspection was performed by USACE Staff, (Drew Clemens, Lawrence Cain, Dr. Ian T. Osgerby) accompanied by Sharon Perkins, NHDES, and Brenda Haslett, EPA. The Site Inspection Form is in Attachment D.

The Site's security is adequate and functioning well. Incidents of vandalism and fires have dropped to near zero, and there have been no incidents of wellhead vandalism since the fence was removed in summer of 2001. The Site is not overgrown, so access to monitoring wells is not inhibited and the former building slabs are still visible (Figures 11-14). A new housing development has been started north of the Site, near the Exeter River, and newer homes are present west of the Site adjacent to Blueberry Road (Figure 15). The residential water supply wells for these homes have not been sampled. The photo lineament data suggest that homes northwest of the Site have the potential to be impacted by contaminated groundwater, if present, within the deep bedrock (Ferguson and others, 1997).

Figure 11 East end of former Piggery Building slab looking toward Brook A.

Figure 12. View across the slab used for drum staging by EPA in 1980-81.

Figure 13. View across the fill within the remediated swale area.

Figure 14. View of Brook A near the confluence of the drainage swale looking north.

Figure 15. View of newer development west of the Site's access gate.

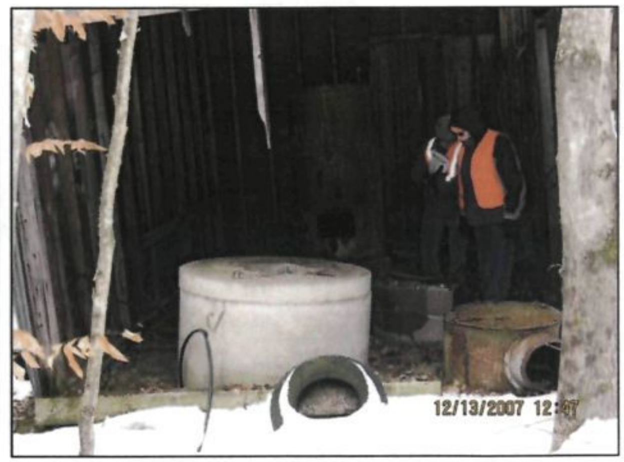

Figure 16. View of concrete structure covering the dug well and the boiler inside the Site's Well Shed.

6.6 Local Interviews

As required in the EPA FYR Guidance Document, interviews were conducted with representatives of the EPA, the NHDES, the town of Raymond and abutting property owners. Local developers could not be reached. Interview Record forms are provided in Attachment E.

Conversations have taken place with property owners abutting the Site, the town manager, and the town health and building inspector. All have expressed concern that the residential wells remain safe for use. Each seems satisfied with the monitoring that has been done to document that safe drinking water is available and with the future residential well and monitoring program conducted by the NHDES. Based on the results of the interviews conducted, implementation of the selected remedy has proceeded without significant issue or concern although the NA remedy has been slower than anticipated.

From the interviews, the main issues were that the contaminated groundwater and monitoring program be continued.

7.0 TECHNICAL ASSESSMENT

Question A: Is the remedy functioning as intended by the decision documents?

No. Natural attenuation of contaminants in groundwater has not proceeded as anticipated or estimated. Surface water sampling ceased in 2004 as sampling results showed no contamination detected at that time. However, in general, the immediate threat from soil exposure has been minimized through completion of removal and treatment measures carried out in accordance with the ROD. FDDA and drainage swale source area soils were removed. Soil was treated with SVE technology as well. The ROD estimated that, after the source area was remediated by the SVE, the overburden groundwater cleanup levels would be achieved within six years and those levels for bedrock groundwater would be achieved within three years. During the second FYR, the contamination appeared to be diminishing but this trend has not continued through the third review period. In fact the trends over the last 15 years show that some wells exhibit increasing concentrations. Such data trends are consistent with the presence of DNAPL at a waste site (see Estimating the Potential for Occurrence of DNAPL at Superfund sites: Office of Solid Waste Publication: 9355.4-07FS). The site's history includes instances of drum burial and possible free liquid off-loading from tanker trucks, consistent an ongoing presence of DNAPL in subsurface soils below and or above the water table. If groundwater fluctuates in elevation and flow direction, more concentrated "slugs" of contaminants can be released from the DNAPL and measured as increased concentrations in downgradient monitoring wells.

During this FYR period, the MCL for arsenic was also reduced from 50 µg/l to 10 µg/l, causing water in several wells to be non-protective. High levels of arsenic were measured in both overburden and bedrock wells. Furthermore, residential development pressures have continued around the Site. Numerous homes have been built adjoining the site boundaries, especially to the northwest.

Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of remedy selection still valid?

No. While RAOs are still appropriate for the site, potential new receptors to the north of the site and the changes in regulatory criteria make it appropriate to consider changes to timelines and considerations for attaining cleanup goals. In addition, the MCL for arsenic was reduced from 50 µg/l to 10 µg/l, causing water in several wells to be non-protective. High levels of arsenic were measured in both overburden and bedrock wells.

Residential development has and continues to occur on properties adjacent to the Site. There are at least two parcels with trace levels of groundwater contamination adjacent to the southern boundary of the Site. Newer homes to the north and west of the Site have yet to be sampled for potential contamination. Pumping stresses could cause contaminant migration toward these newer homes. As additional homes are built and water consumption increases, it will be important to monitor the area for indications of migration of contamination towards the north, west and south.

Toxicity data for almost all Site COC's remains unchanged. There has been some work recently on the toxicity of arsenic, specifically methylated species of arsenic, though insufficient data exists to assess the nature and migration/retardation mechanisms of arsenic at the Site. With the high concentrations of arsenic in some of the wells, a recommendation is made for obtaining additional arsenic data from both residential and Site monitoring network wells.

Three groundwater cleanup levels have changed since the ROD was signed. First, the cleanup level for THF was set at 154 μg/l based on a promulgated Ambient Groundwater Quality Standard in Env-Wm 1403 (Table 600-1 of that document). All monitoring wells contain less than 154 μg/l of THF, so the remedy remains protective and is in compliance with this ARAR. The second change was for 1,2-dichloroethene (DCE). Previously a total value was measured and reported, now the two components of 1,2-DCE are analyzed separately. Cis-1,2-DCE has a drinking water standard of 70 μg/l, and trans-1,2-DCE has a drinking water standard of 100 μg/l. Levels of both of these compounds have been decreasing, but cis-1, 2-DCE still exceeds its drinking water standard in well MO-3DR completed in weathered bedrock downgradient (east) from the FDDA. Finally, the drinking water standard for arsenic was lowered from 50 μg/l to 10 μg/l in the year 2001. With its persistence in the environment (USEPA, 2007a) and the uncertainty of a predictable source(s) at the Site, attaining compliance with cleanup levels will likely be different than for the chlorinated VOCs.

<u>Question C: Has any other information come to light that could call into question the protectiveness of the remedy?</u>

No. No other data/information than that noted above became available during the preparation of this FYR. The information identified above and in this FYR is of sufficient weight to determine that the current remedy is not meeting the intent of the ROD. Cleanup goals have not been met as expected and there is at least one more stringent cleanup criteria now in place. There are uncertainties with limited data sets that may be resolved with focused measures allowing determination that the remedy for the site can be fully protective.

The following support the determination that the remedy at the Mottolo Superfund Site is not protective of human health and the environment onsite.

- The high arsenic concentrations near Brook A have persisted over the past five years.
- Natural attenuation is not proceeding as expected. While concentrations of some contaminants have leveled off, others have increased. Seasonal variations in groundwater levels may be influencing mobilization of contaminants into the aquifer and perhaps surface water (at Brook A) as well.
- Offsite migration of potentially contaminated groundwater, especially to the north and west, cannot be assessed due to a lack of data in this area.
- The Site's impact to Brook A, and exposure to trespassers, cannot be assessed due to a lack of adequate sampling and sample data.
- Accelerated land use in the form of residential development has occurred adjacent to the Site since the remedial action was completed. The monitoring plans designed to assess the potential for ingestion of contaminated groundwater does not include these newer residences being built to the north and west of the site.

Technical Assessment Summary

According to the data reviewed, the remedy is no longer protective because COC concentrations are increasing in groundwater from several monitoring wells. Analysis indicates that natural attenuation has not occurred uniformly across the Site over the last five or more years and that the estimated cleanup times as specified in the Record of Decision have not been achieved. Although concentrations of TCE in groundwater are generally declining in areas of highest concentrations, a residual mass of VOCs in soil and bedrock may still serve as a source from isolated pockets, possibly in the form of dense nonaqueous phase liquid (DNAPL). These sources may be delaying the projected cleanup times reported in the ROD. Episodic transport of chemicals in shallow sediments during periods of high groundwater levels may cause some variability in concentrations observed at monitoring wells. Arsenic levels in groundwater vary from non-detect to over 1,000 µg/L. These levels remain above federal and state allowable limits in five out of six wells sampled for Arsenic. Arsenic concentrations in groundwater appear to be increasing in Well MO-3SR, but no trends are apparent in other wells sampled for arsenic (Figure 7). Concentrations in Well OW-4SR have been near or below detection levels since 2003. Samples from wells OW-2DR, MO-2S, MO-3DR and MO-3SR have consistently had arsenic concentrations above the old MCL of 50 µg/L.

Additional characterization of contaminants in soil, additional groundwater and surface water sampling, inspection/replacement/repair of wells, evaluation of well head treatment and finalization of institutional controls are needed to fully assess and ensure protectiveness. It should be noted, however, there are no known exposures occurring due to any of the Site-related COCs for groundwater and the immediate threats from soil were addressed by completed remedial activities.

8.0 ISSUES

Inquiries have been received by NHDES concerning the development of the Mottolo property. While portions of the property might support clean residential wells, much of the property should be restricted to ensure that contaminated groundwater is not used for human consumption. Access to Brook A may also have to be restricted, depending on future sample results.

Increased water use resulting from residential development adjacent to the Site needs to be carefully monitored to ensure that fractured bedrock groundwater flow patterns and pathways for contaminants are not altered.

This Five-Year Review has identified several issues listed in Table 8.

Table 8. Issues at the Mottolo Superfund Site, Raymond, New Hampshire.

Issues	Affects Current Protectiveness	Affects Future Protectiveness
Potential residual source areas in soil and/or weathered bedrock onsite. May influence offsite and onsite groundwater quality, and potentially impact surface water quality in Brook A where only limited sampling has occurred.	Yes	Yes
Insufficient sampling to determine seasonal groundwater and surface water contaminant variation and to assess potential remobilization of contaminants onsite (near Brook A) and offsite to the west and north.	Yes	Yes
Some wells may not yield representative water samples due to biofouling or siltation.	No	Yes
Concentrations of arsenic and VOCs remain above cleanup goals.	Yes	Yes
Institutional Controls not finalized, accompanied by sustained residential development pressure near the Site.	Yes	Yes

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

It is recommended that the following actions (Table 9) be undertaken to address the issues identified in this FYR.

Table 9. Recommendations and Follow-up Actions for the Mottolo Pig Farm Superfund Site, Raymond, New Hampshire.

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Potential residual source areas in soil and/or weathered bedrock. May affect offsite and onsite groundwater quality, and potentially impact surface water quality in Brook A where only limited sampling has occurred.	Investigate Suspected Residual Contaminant Source Areas. Investigate soil and weathered bedrock near high arsenic and VOC detections. Remove soil if necessary. If SBA area wells are sound, conduct a geophysical survey to assess boundary of potential residual source area.	EPA	EPA	12/30/2009	Yes	Yes
Insufficient sampling to determine seasonal groundwater and surface water contaminant variation and to assess potential mobilization of contaminants onsite (near Brook A) and offsite exposure to the west and north.	Revise Groundwater and Surface Water Sampling Plan. Use low-flow sampling for all wells unless there is a well-specific problem which cannot be overcome. Sample domestic wells north and west of the site during high and low groundwater conditions. Re-institute seasonal surface water and groundwater monitoring during high and low groundwater conditions. Evaluate contaminant pathways and determine if new monitoring wells are needed at the Site boundaries. Locate groundwater to surface water discharge areas and evaluate the concentration of groundwater contaminants entering the brook. Optimize Site/residential well sampling frequency. Evaluate the need for well head treatment.	NHDES	EPA	6/30/2009	Yes	Yes
Some wells may not yield representative water samples which may be due to biofouling or siltation	Evaluate well conditions. Physically and hydraulically inspect/re-develop all monitoring wells. Remove and/or replace poorly performing monitoring wells.	NHDES	EPA	6/30/2009	No	Yes

Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness	
					Current	Future
Concentrations of arsenic and VOCs remain above cleanup goals.	Collect additional arsenic and VOC data. Include arsenic as analyte for four rounds of surface water, residential and Site groundwater monitoring well networks; optimize each successive round based on the results. Sample some residential wells for full suite of contaminants vs. COCs only. Collect additional natural attenuation (NA) parameters. Apply analytical techniques to refine estimates of cleanup times.	NHDES	EPA	6/30/2009	Yes	Yes
Institutional Controls not finalized, accompanied by sustained residential development pressure near the Site.	Re-Assess Institutional Controls. Finalize Institutional Controls.	NHDES/EPA	EPA	6/30/2009	Yes	Yes

10.0 PROTECTIVENESS STATEMENTS

The remedy is no longer protective because of persistence and increases in some COC concentrations in groundwater from several monitoring wells since the last FYR. Several issues raised during this review have led to recommendations to improve monitoring and evaluation of contamination. Analysis indicates that natural attenuation has not occurred uniformly across the Site over the last five or more years and that the estimated cleanup times as specified in the ROD have not been achieved. Also, the cleanup objective for arsenic in groundwater was lowered from 50 µg/L to 10 µg/L, though there are no known exposures occurring due to any of the Site-related COCs for groundwater. Residential development around the site continues with increasing pressures on the groundwater resources that may create the likelihood of exposure.

The immediate threats from soil were addressed by completed remedial activities. However, additional investigation of contaminants in soil and/or weathered bedrock, additional groundwater and surface water sampling, evaluation of well conditions to include inspection/replacement/repair of wells, evaluation of well head treatment and finalization of institutional controls are needed to fully assess and ensure protectiveness.

11.0 NEXT REVIEW

The next FYR should be completed within five years of the finalization of this review.

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NHDES, 2007b. March 2007 Quarterly Residential Sampling Report, Mottolo Pig Farm Superfund Site Blueberry Hill Road, Raymond, New Hampshire, DES #198704094.

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ATTACHMENT A – ARAR Analysis

Applicable or Relevant and Appropriate Requirements (ARARs) for the Mottolo Superfund Site were identified in the ROD (USEPA, 1991) as follows:

Chemical-Specific:

Federal Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs).
RCRA 40 CFR 264.94 Maximum Concentration Limit for arsenic.
Federal National Ambient Air Quality standards during construction activities.
New Hampshire Ambient Air Quality Standards ENV-A:300 for construction and operation.
New Hampshire Toxic Air Quality Pollutants ENV-A:1300 for soil vapor extraction.

Location-Specific:

Federal Executive Order 11990 (Protection of Wetlands) for remedial activities.
Federal Clean Water Act, Section 404 (40 CFR Part 230; 33 CFR Parts 320-330) for work performed in wetland areas near the drainage swale.
New Hampshire Dredging and Control of Runoff; RSA 149:8-a: Dredging Rules (Ws Ch. 400 Part 415) for work performed in wetland areas and in the vicinity of Brook A (discharge trench).
New Hampshire Fill and Dredge in Wetlands, Criteria and Conditions (RSA 483-A, Ws Ch. 300, and Wt Chapters 100 through 700) for activities in the drainage swale and near Brook A valley wetland areas.

Action-Specific:

Federal Resource Conservation and Recovery Act (RCRA)(40 CFR 264, Subpart X) for soil vapor extraction.
Federal Clean Water Act (40 CFR Parts 122 and 125) for diverted groundwater and construction runoff.
Federal Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (29 CFR 1910.120) for construction and operation.
Federal OSHA Safety and Health Standards for Construction Sites (29 CFR 1926.652).
Federal Rivers and Harbors Act (33 CFR 320-329) for activities in the drainage swale and Brook A valley wetland areas.
Federal Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR 230) for remedial activities.
New Hampshire Hazardous Waste Facility Security Requirements (Env-Wm 708.08(c), 40 CFR 264.14).
Groundwater Protection (Env-Wm 708.02 (j), 40 CFR 264, Subpart F).
Closure and Post-closure (Env-Wm 708.02 (k), 40 CFR 264, Subpart G).
Post-Closure Requirements (Env-Wm 708.03 (d)(6), 40 CFR 264, Subpart F-Landfills).
Technical Standards for Tanks (Env-Wm 708.03 (d)(2), 40 CFR, Subpart J-Tanks).
New Hampshire Groundwater Protection Regulations (Ws 410) Groundwater Quality Criteria.
New Hampshire Air Regulations, Toxic Air Pollutants (Chapter Env-A 1300).
Fugitive Dust Emission Control (NH Administrative Code, Air, Part 1002).

Additionally, the ROD identifies the following as "To-Be Considered" criteria:

To Be Considered (TBC):

Federal SDWA Maximum Contaminant Level Goal for 1,1-dichloroethene (chemical-specific TBC).

Federal New Hampshire Groundwater Protection Standards (WS 410.05) (chemical-specific TBC).

Federal Statement of Procedures on Floodplain Management and Wetland Protection (40 CFR Part 6, Attachment A) to implement Executive Order 11990 (location-specific TBC).

The location-specific and action-specific requirements are precautions that apply to the removal actions, such as the construction and operation of the interceptor trench and soil vapor extraction system as specified for the source control operable unit. The ROD noted that many of the location specific requirements could not completely be met because some disturbance of the wetland was to be expected during active remediation. The goal thus was to minimize unavoidable disturbances to the wetland. These requirements are not applicable to the current five-year review period since no active remediation has occurred during the last five years (e.g., the vacuum extraction system was completely removed in 2001). The following are noted as changes in the action-specific and location-specific requirements that could affect potential (currently unplanned) remedial activities:

State of NH initially received Final authorization of the RCRA program on December 18, 1984. The Federal Register Vol. 71, No 38 / Monday, February 27, 2006 / Rules and Regulations "re-authorizes" the State of New Hampshire's RCRA program, effective on April 28, 2006, to reflect changes in the state program due to changes in the federal program.

State of NH Hazardous Waste Management Requirements were subject to revisions finalized on June 25, 2002 (prior to this review period), including: (1) changes to the standards for used oil generators, transporters, processors, re-refiners, burners and marketers; (2) the universal waste rule, which established reduced management requirements for hazardous waste batteries, thermostats, pesticides and lamps; and (3) the addition of used electronics to the State's universal waste rule.

State of NH regulations governing well drilling industry and noise generation are applicable during the installation of additional monitoring wells.

Changes made to federal RCRA (40 CFR 264 Subpart G post-closure regulations) since the ROD include: (1) allowing governing agencies the use of a variety of authorities to impose requirements based on the particular facility; (2) modifications to the regulations to allow facilities to address certain units through the corrective action program; and (3) specification of Part B information submission requirements for facilities that receive post-closure permits.

The chemical-specific requirements are applicable to the natural attenuation under the management of migration. Most pertinent to this review are the chemical-specific requirements and TBC issues relating to the short and long-term effectiveness of the remedy. Of particular interest are changes to standards and toxicity values that may have implications for the cleanup goals set in the ROD. During the current review period no changes were implemented that affect any of the existing state or federal ARARs, with one exception. The SDWA was last amended in 1996, and in 2001, the federal maximum contaminant Level (MCL) for arsenic was promulgated, becoming effective in 2006. The former MCL for arsenic in drinking water was 50 µg/l, whereas it is now set at a more stringent limit of 10 µg/l under both federal and NH state drinking water programs.

Examination of the EPA's Integrated Risk Information System (www.epa.gov/iris) indicates no change to the toxicity values for the COCs during the review period. This means that the cleanup goals remain protective. Table A-1 summarizes the assessment of toxicity values supporting the remedy.

Table A- 1. Evaluation of changes to oral toxicity values for human health.

Contaminant of Concern	Mode of Effect	Toxicity Value Circa 1990 (RI/FS)	Toxicity Value Circa 2008	Most Recent Evaluation on IRIS	Any Change?	Implication for Remedy
Arsenic (unspeciated total)	Noncancer	NA	0.0003 mg/kg/day	12/01/93	Yes	Minimal since cancer effects result in more stringent cleanup goals.
	Cancer	1.8 $(mg/kg/day)^{-1}$	1.5 $(mg/kg/day)^{-1}$	4/10/98	Yes, but prior to review period.	Slightly less stringent value in place now; cleanup goals remain protective.
1,1-Dichlorethylenes	Noncancer	NA	0.05 mg/kg/day	08/13/02	Yes, but prior to review period.	Slightly less stringent value in place now; cleanup goals remain protective.
	Cancer	0.0091 $(mg/kg/day)^{-1}$	NA	08/13/02	Yes, but prior to review period.	Uncertain with no current toxicity value. Total risk associated with contaminants in groundwater will be evaluated when all cleanup goals are met.
Ethylbenzene	Noncancer	0.1 mg/kg/day	0.1 mg/kg/day	06/01/91	No	None
	Cancer	NA (not classifiable)	NA (not classifiable)	08/01/91	No	NA
Tetrahydrofuran	Noncancer	0.002 mg/kg/day	NA	NA	NA	Uncertain with no current toxicity value. Total risk associated with contaminants in groundwater will be evaluated when all cleanup goals are met.
	Cancer	NA	NA	NA	NA	NA
Toluene	Noncancer	0.3 mg/kg/day	0.08 mg/kg/day	09/23/05	Yes	The risk associated with the cleanup goal is increased. Total risk associated with contaminants in groundwater will be evaluated when all cleanup goals have been met.
	Cancer	NA (insufficient data)	NA (insufficient data)	09/23/05	No	NA
1,1,1-Trichloroethane	Noncancer	0.09 mg/kg/day	2 mg/kg/day	09/28/07	Yes	Less stringent value in place now; cleanup goals remain protective .
	Cancer	NA	NA	09/28/07	No	NA

Contaminant of Concern	Mode of Effect	Toxicity Value Circa 1990 (RI/FS)	Toxicity Value Circa 2008	Most Recent Evaluation on IRIS	Any Change?	Implication for Remedy
Trichloroethylene	Noncancer	NA	Not Available	08/01/92	Under Review	The toxicity value is under review. Total risks associated with groundwater contaminants will be evaluated when all cleanup goals are met.
	Cancer	0.011 $(mg/kg/day)^{-1}$	Under Review	07/01/89	Under Review	The toxicity value is under review. Total risks associated with groundwater contaminants will be evaluated when all cleanup goals are met.
Vinyl Chloride	Noncancer	NA	0.003 mg/kg/day	08/07/00	Yes, but prior to review period.	The risk associated with the cleanup goal is increased. Total risks associated with groundwater contaminants will be evaluated when all cleanup goals are met.
	Cancer	0.0023 mg/kg/day-1	1.5 mg/kg/day-1	08/07/00	Yes, but prior to review period.	The risk associated with the cleanup goal is increased. Total risks associated with groundwater contaminants will be evaluated when all cleanup goals are met.

ATTACHMENT B - Groundwater Chemistry Graphs and Field Water Quality Tables

Introduction to Attachment B

The following graphs show concentrations of chemicals of concern (COCs) in water from monitoring wells sampled from 1992 to 2007. Also shown on each graph are water levels measured in one of two U.S. Geological Survey (USGS) monitoring wells to assess possible effects of hydrologic conditions on concentration trends. Water levels for USGS Well NH-DDW 46 are shown with wells completed in overburden, and water levels of USGS Well NH-HTW5 are shown for wells completed in bedrock. USGS well locations are shown on Figure B-1. Water-level data for USGS wells are from USGS, 2008a; 2008b; and 2008c.

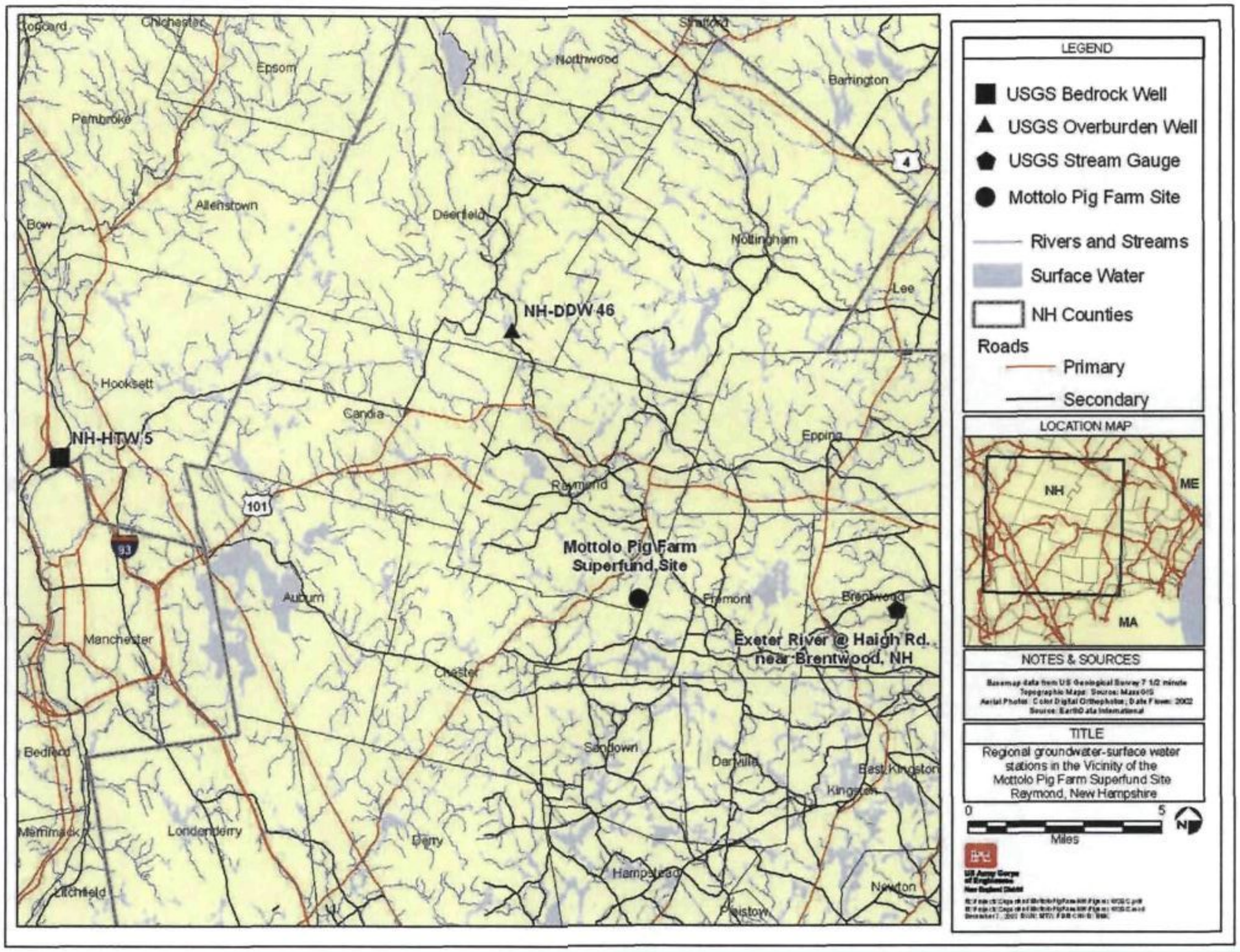
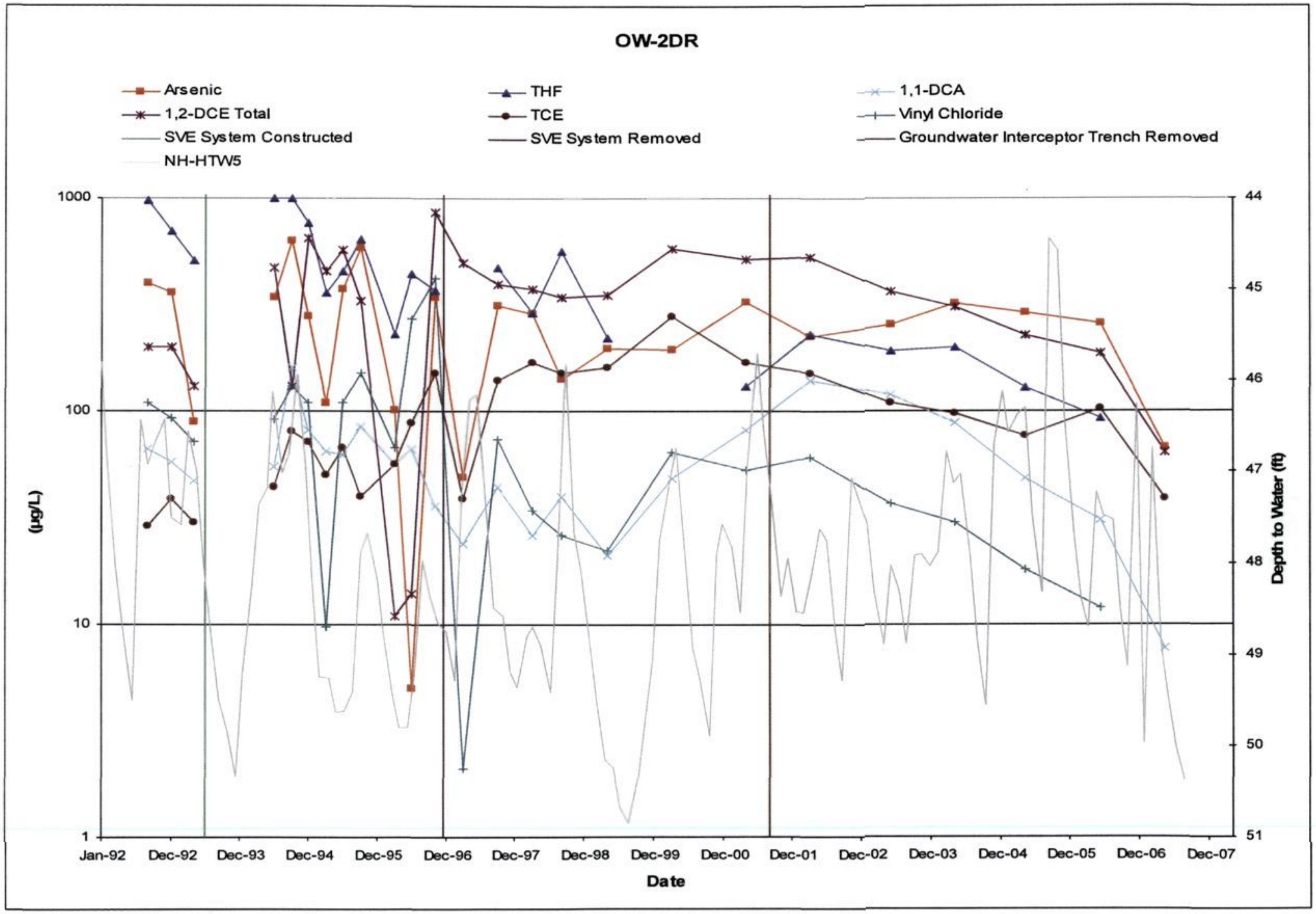
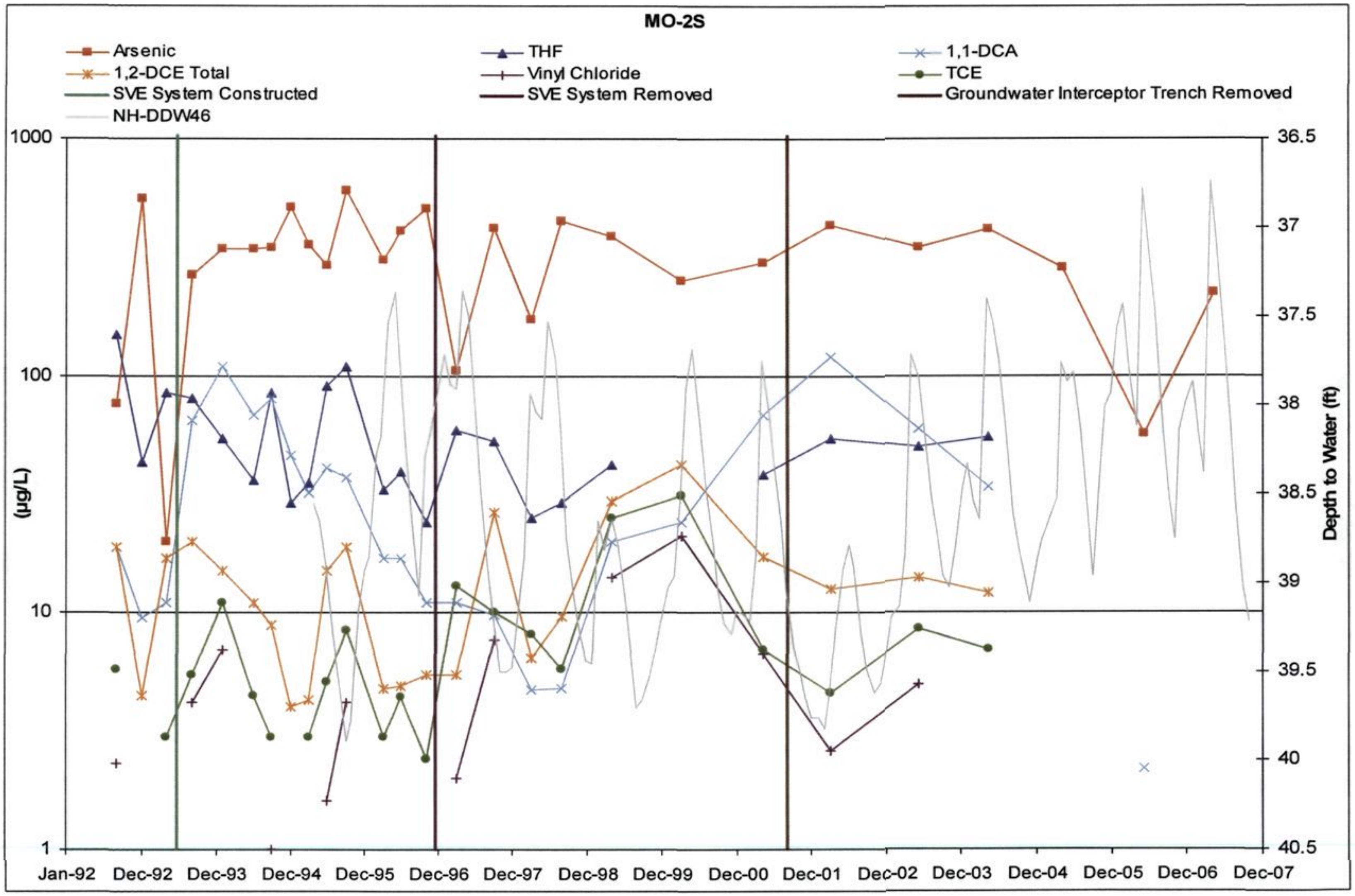
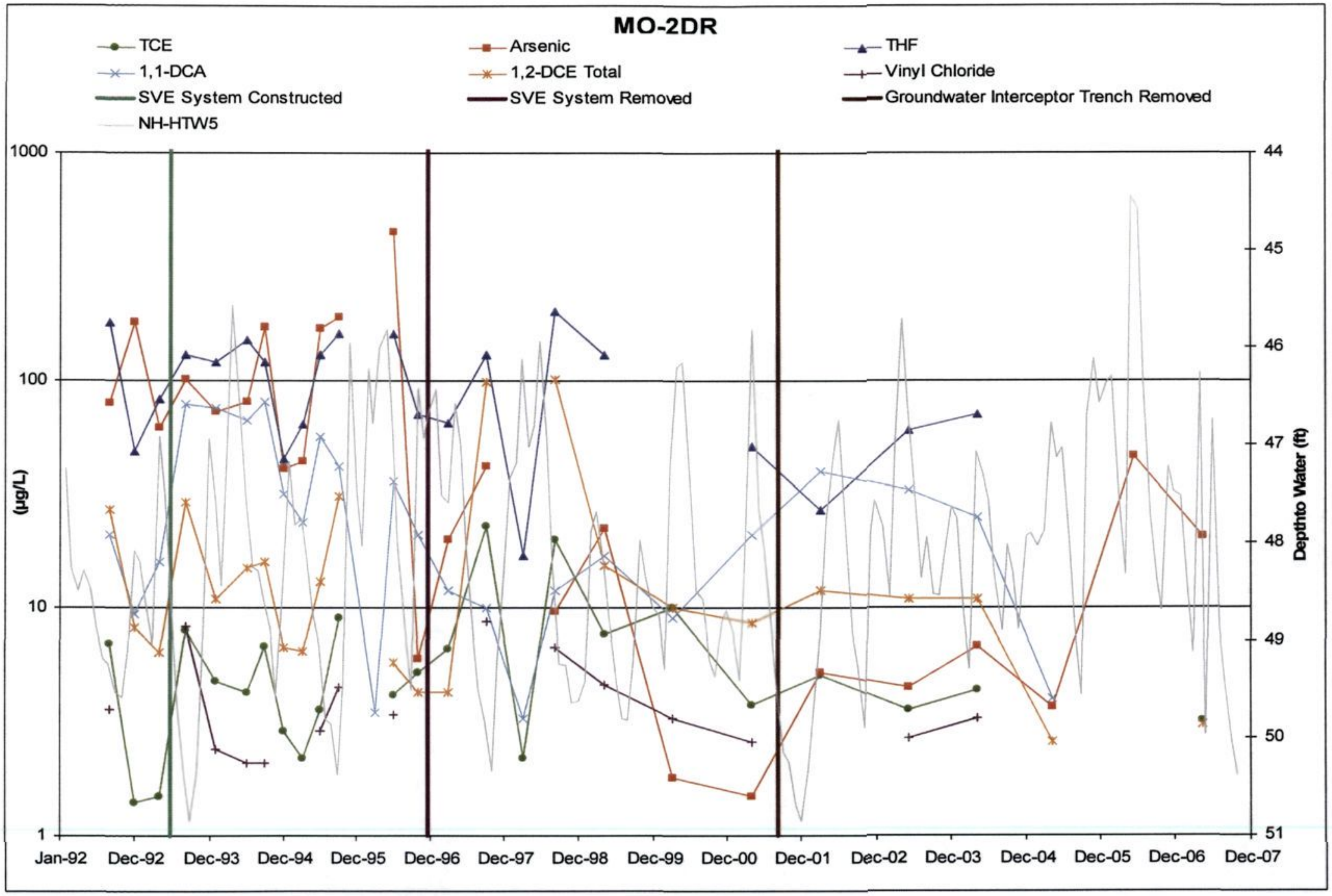


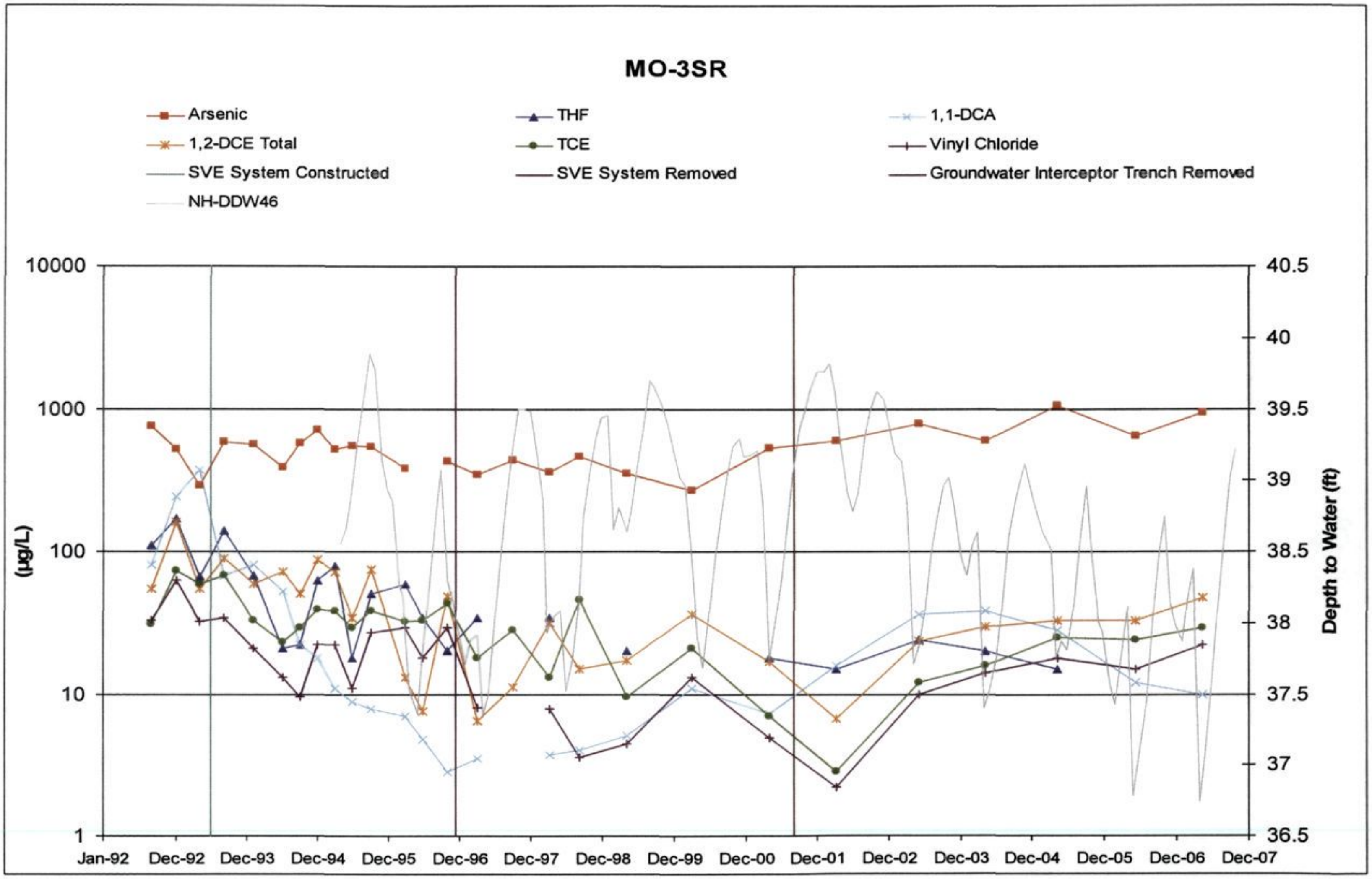
Figure B-1. Locations of USGS groundwater and surface water stations used for seasonal trend analysis, Mottolo Pig Farm Superfund Site, Raymond, New Hampshire.


OW-2DR
Arsenic
THF
1,1-DCA
1,2-DCE Total
TCE
Vinyl Chloride
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-HTW5
1000
100
10
1
(µg/L)
44
45
46
47
48
49
50
51
Depth to Water (ft)
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07
Date

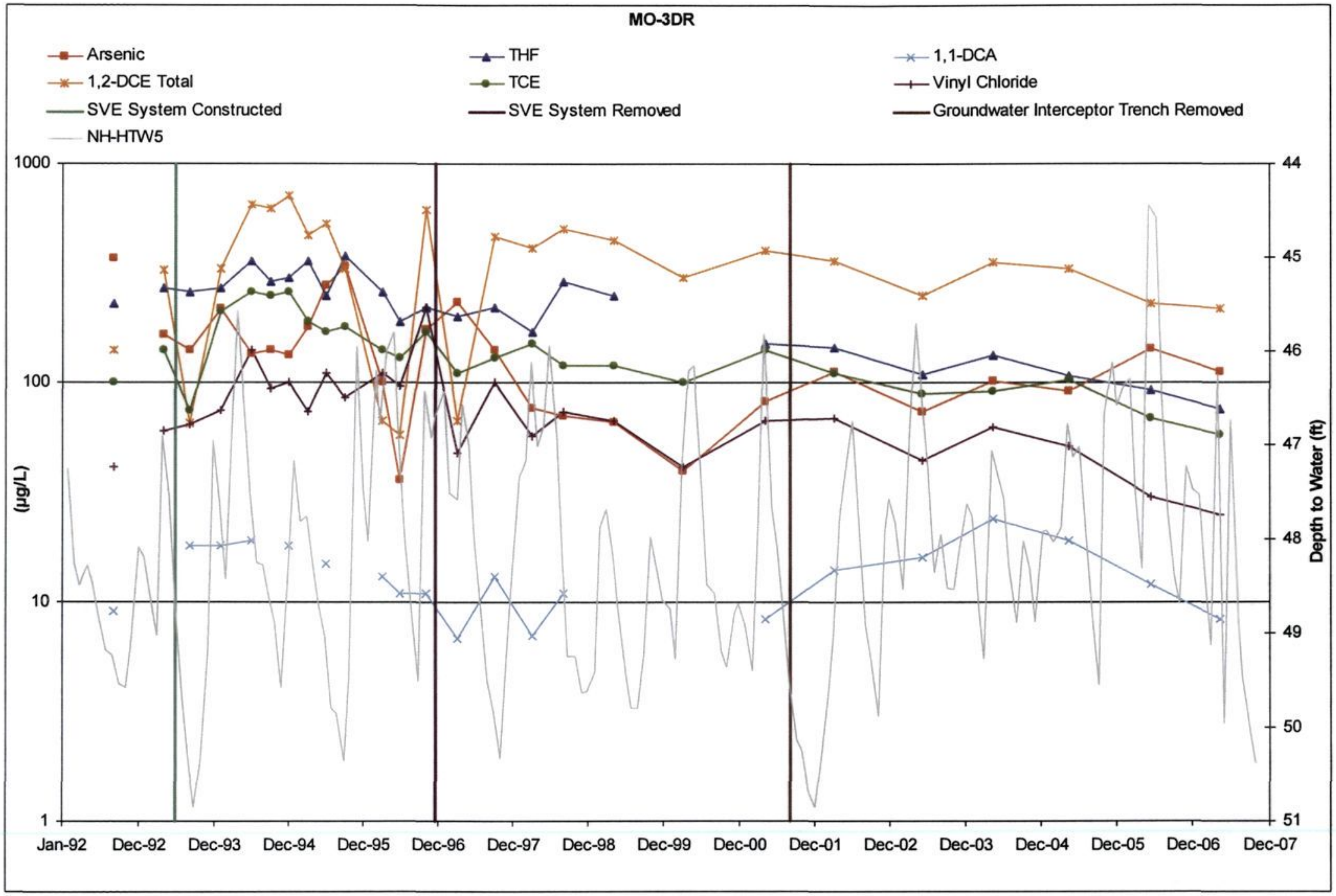

MO-2S
Arsenic
THF
1,1-DCA
1,2-DCE Total
Vinyl Chloride
TCE
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-DDW46
(µg/L)
Depth to Water (ft)
1000
100
10
1
36.5
37
37.5
38
38.5
39
39.5
40
40.5
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07

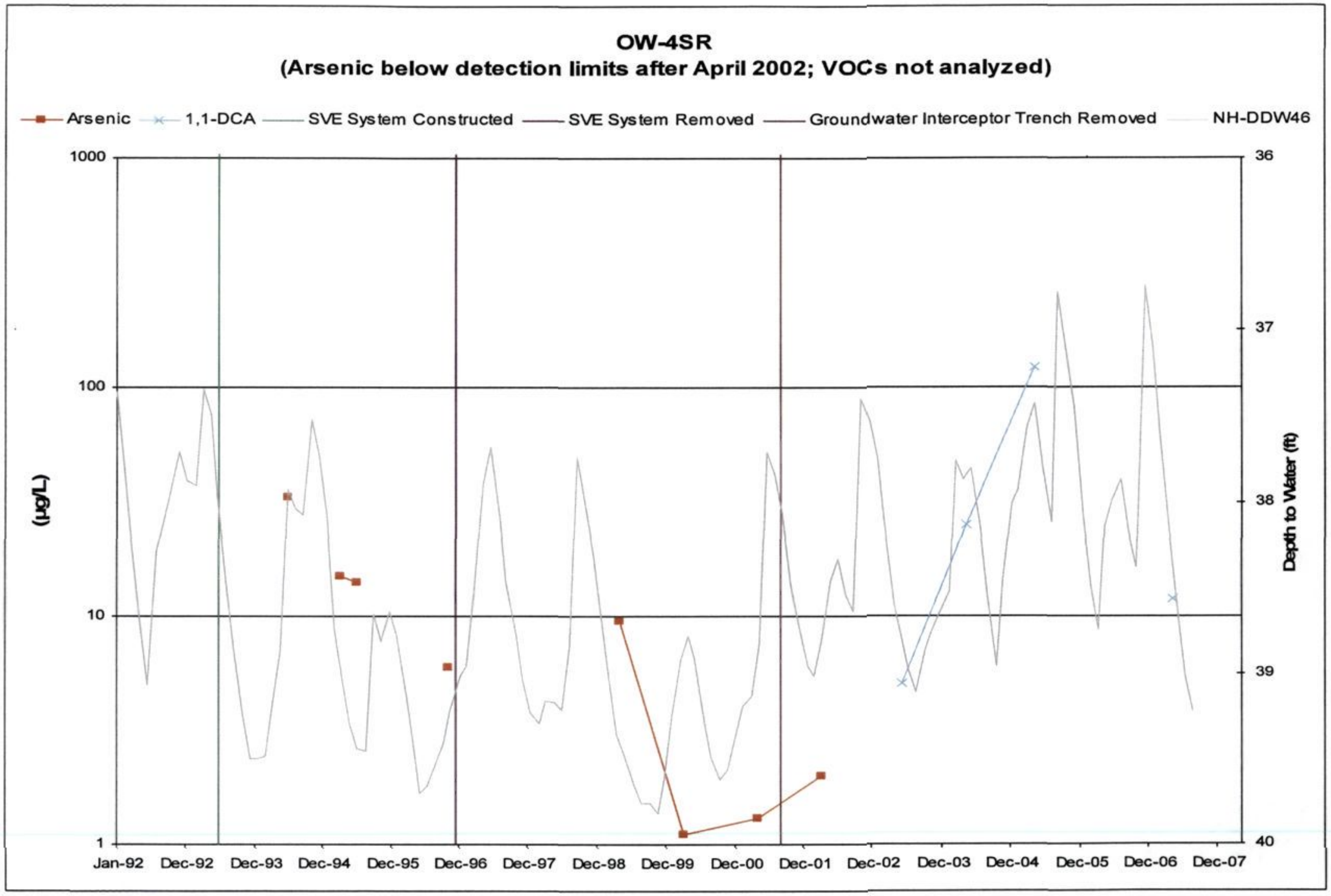


MO-2DR
TCE
Arsenic
THF
1,1-DCA
1,2-DCE Total
Vinyl Chloride
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-HTW5
(µg/L)
Depthto Water (ft)
1000
100
10
1
44
45
46
47
48
49
50
51
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07



MO-3SR
Arsenic
THF
1,1-DCA
1,2-DCE Total
TCE
Vinyl Chloride
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-DDW46
10000
1000
100
10
1
(µg/L)
40.5
40
39.5
39
38.5
38
37.5
37
36.5
Depth to Water (ft)
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07


MO-3DR
Arsenic
1,2-DCE Total
SVE System Constructed
NH-HTW5
THF
TCE
SVE System Removed
1,1-DCA
Vinyl Chloride
Groundwater Interceptor Trench Removed
(µg/L)
1000
100
10
1
Depth to Water (ft)
44
45
46
47
48
49
50
51
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07


OW-4SR
(Arsenic below detection limits after April 2002; VOCs not analyzed)
Arsenic
1,1-DCA
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-DDW46
1000
100
10
1
(µg/L)
36
37
38
39
40
Depth to Water (ft)
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
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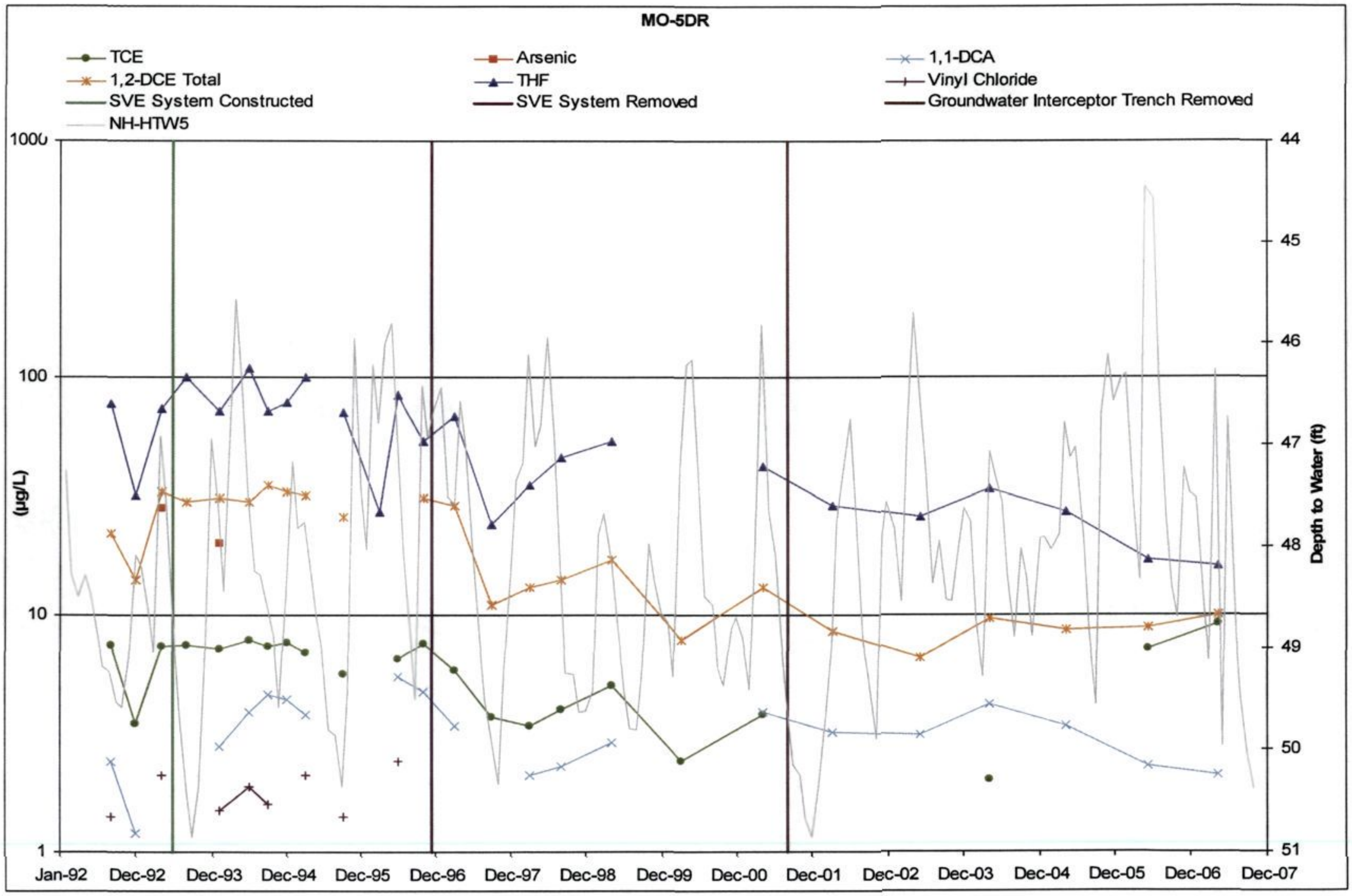
Dec-05
Dec-06
Dec-07



MO-5DR
TCE
Arsenic
1,1-DCA
1,2-DCE Total
THF
Vinyl Chloride
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-HTW5
(µg/L)
Depth to Water (ft)
1000
100
10
1
44
45
46
47
48
49
50
51
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
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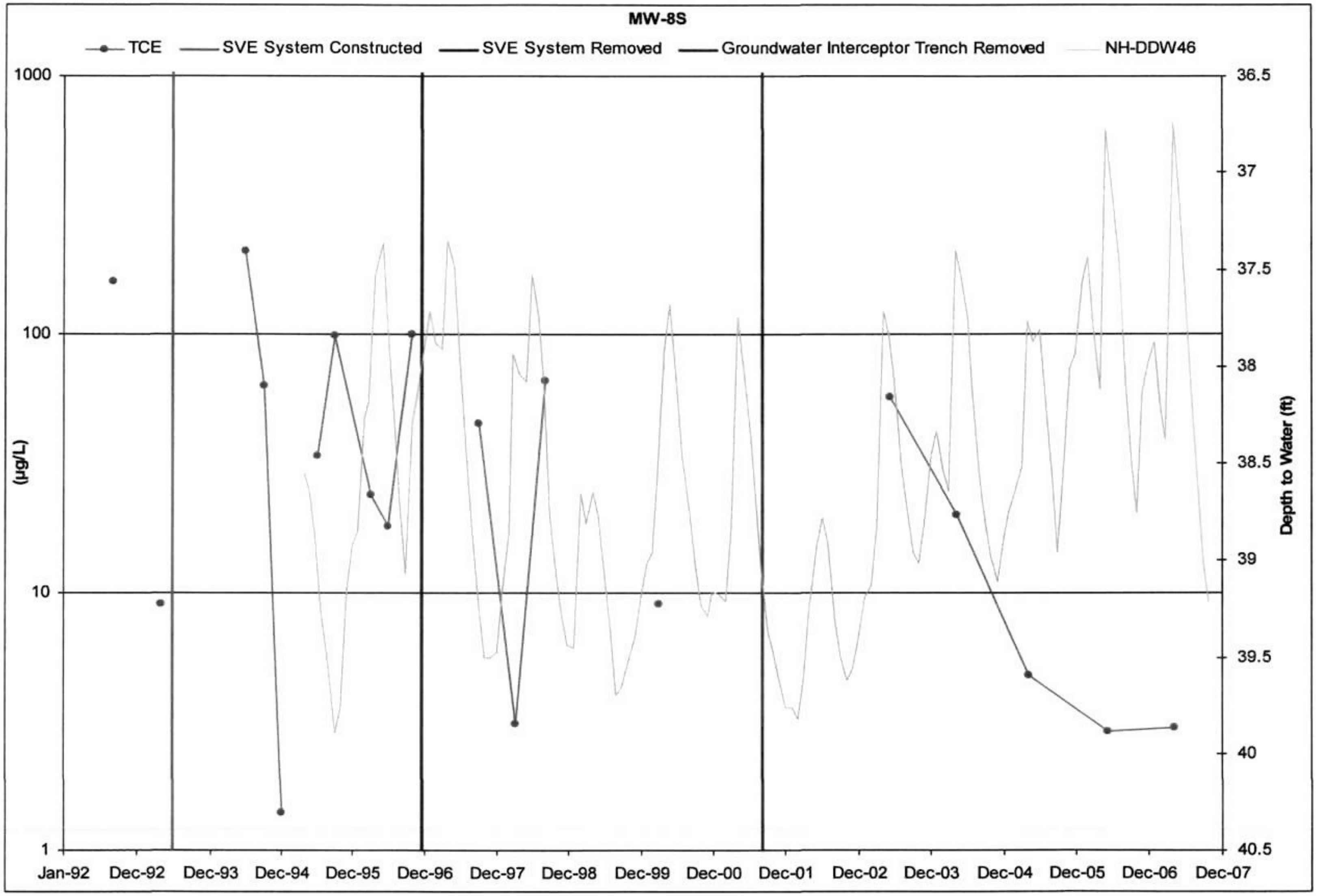
Dec-05
Dec-06
Dec-07


MW-8S
TCE
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-DDW46
1000
100
10
1
(µg/L)
36.5
37
37.5
38
38.5
39
39.5
40
40.5
Depth to Water (ft)
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
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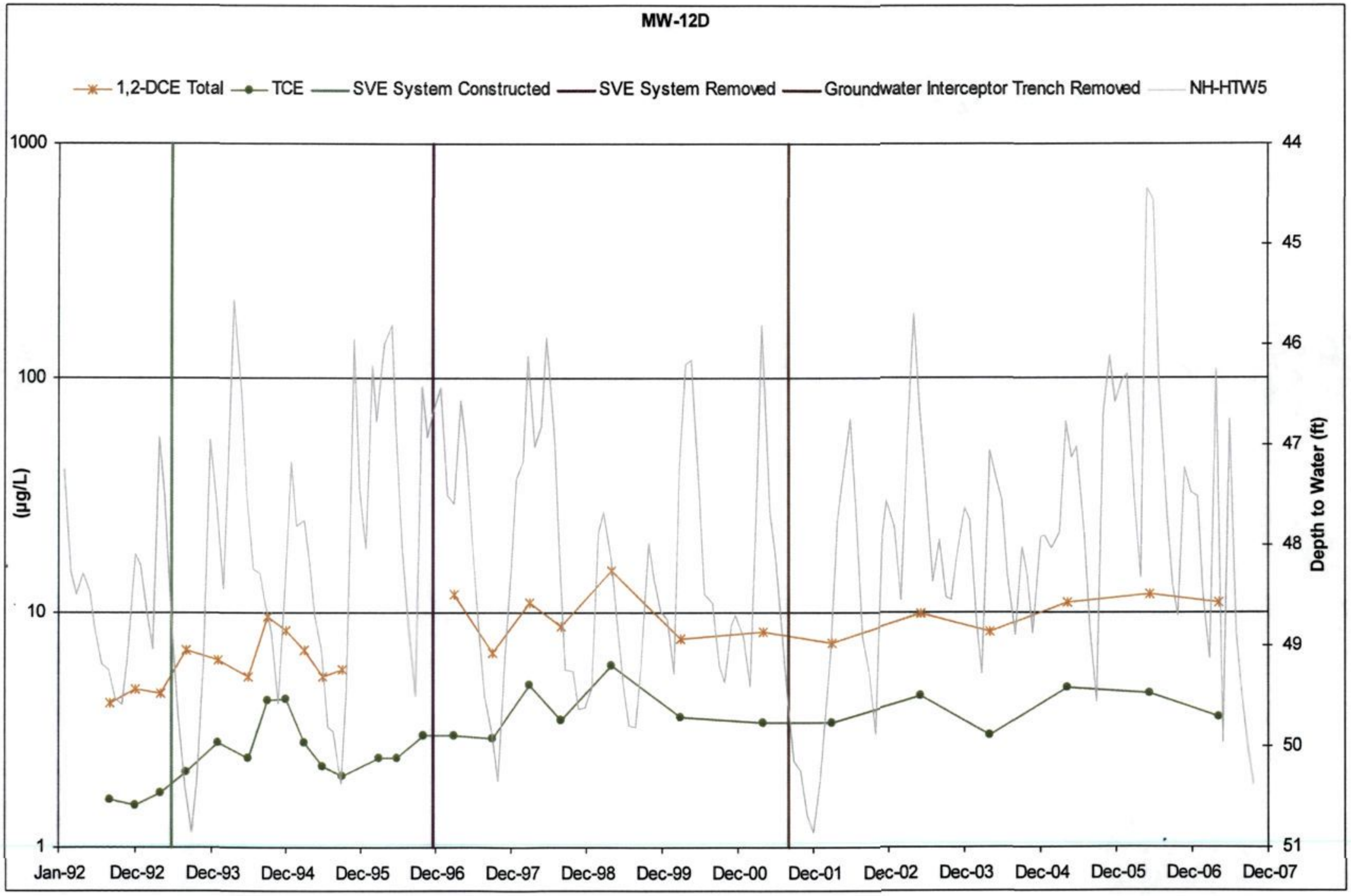
Dec-07



MW-12D
1,2-DCE Total
TCE
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-HTW5
1000
100
10
1
(µg/L)
44
45
46
47
48
49
50
51
Depth to Water (ft)
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
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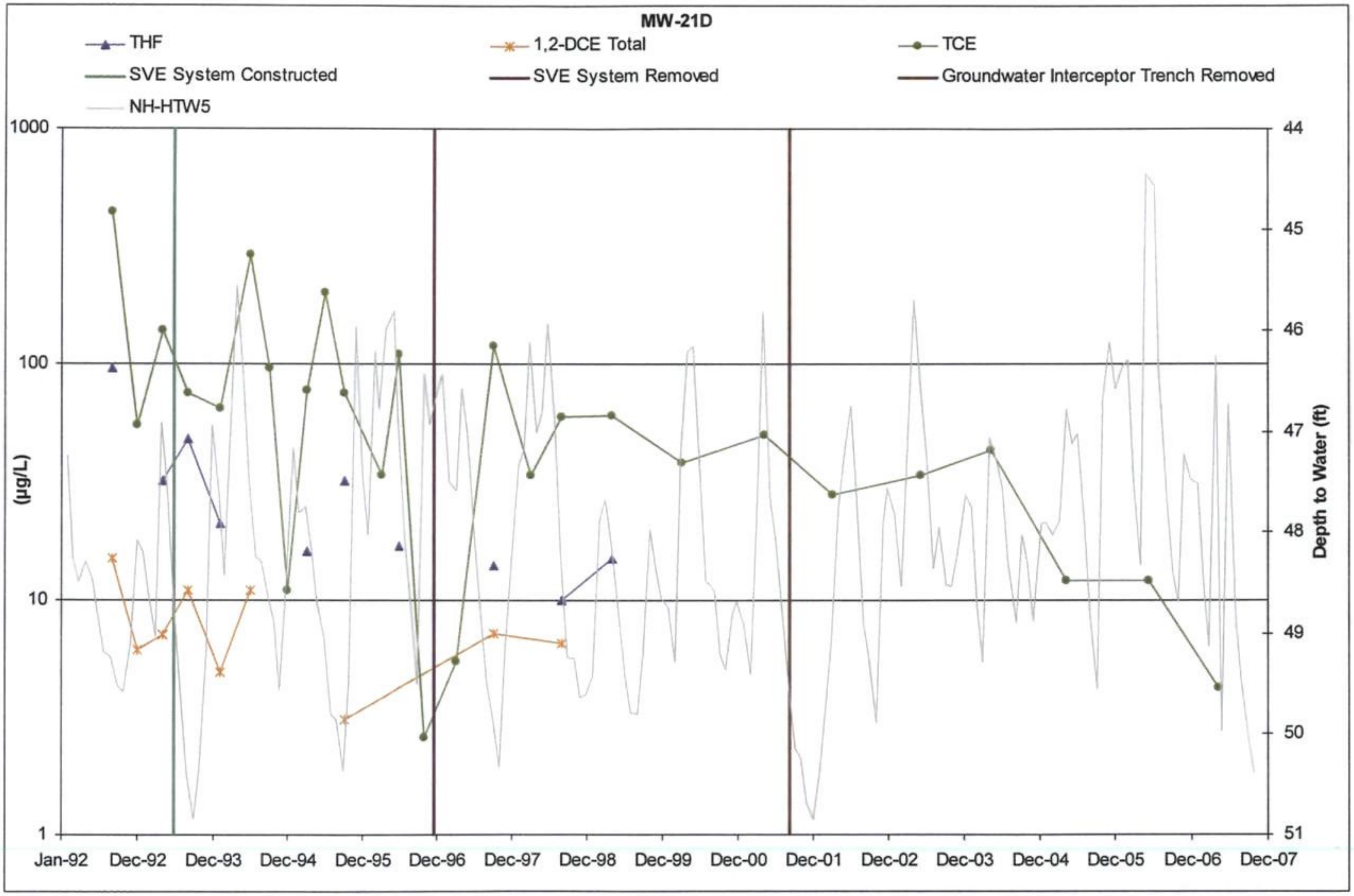
Dec-07



MW-21D
THF
1,2-DCE Total
TCE
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-HTW5
1000
100
10
1
(µg/L)
44
45
46
47
48
49
50
51
Depth to Water (ft)
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
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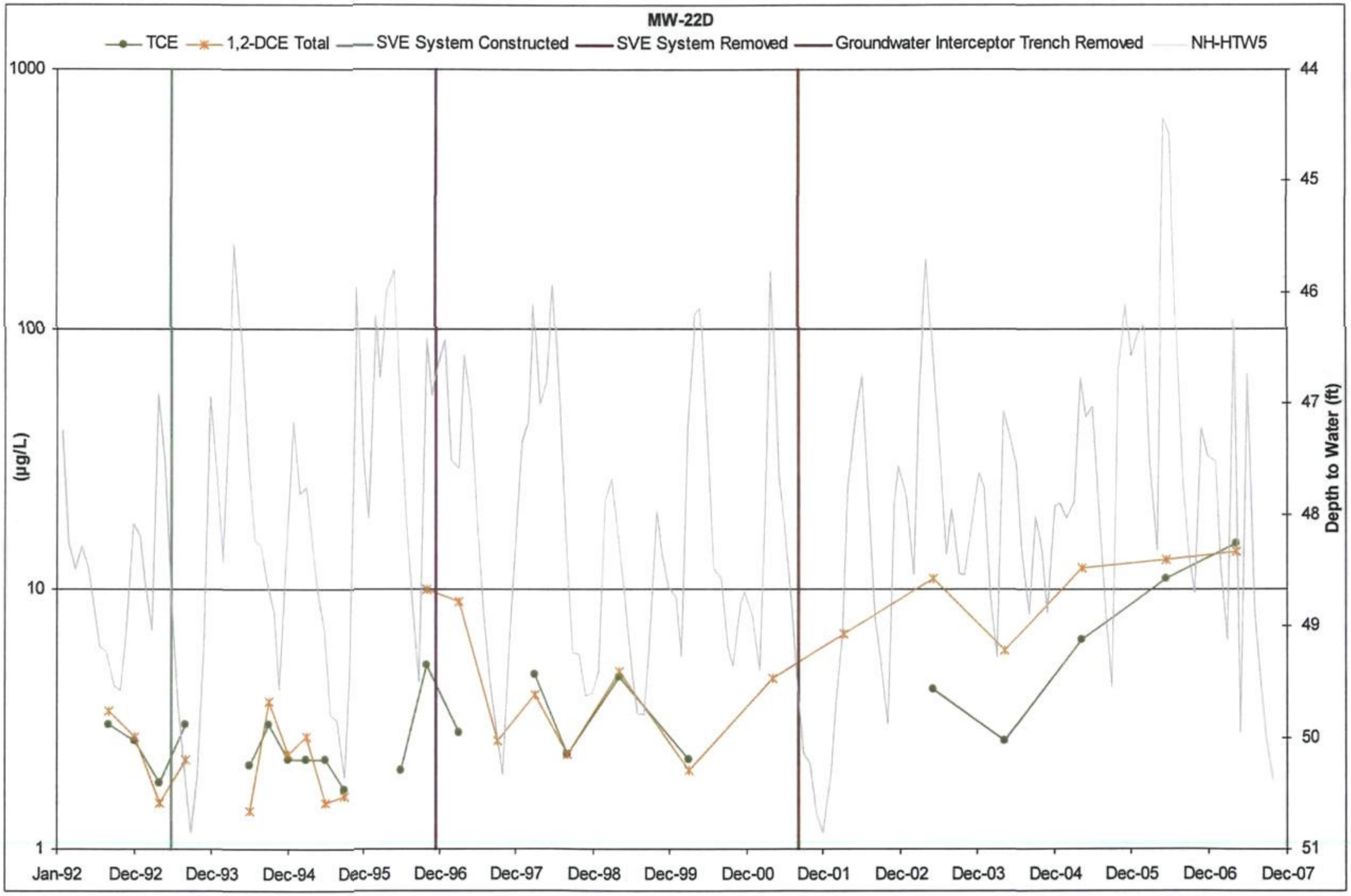
Dec-06
Dec-07


MW-22D
TCE
1,2-DCE Total
SVE System Constructed
SVE System Removed
Groundwater Interceptor Trench Removed
NH-HTW5
1000
100
10
1
(µg/L)
44
45
46
47
48
49
50
51
Depth to Water (ft)
Jan-92
Dec-92
Dec-93
Dec-94
Dec-95
Dec-96
Dec-97
Dec-98
Dec-99
Dec-00
Dec-01
Dec-02
Dec-03
Dec-04
Dec-05
Dec-06
Dec-07

M0-2DR SHALLOW BEDROCK WELL

Parameter	24-May-01	29-Apr-02	5-Jun-03	24-May-04	23-May-05	15-Jun-06	23-May-07
As (µg/L)	1.5	5.2	4.5	6.8	3.7	46.3	20.4
TCE (µg/L)	3.8	5.1	3.6	4.4	BDL	ND	3.2
DO (mg/L)	*	0.9	0.9	1.4	2	*	*
ORP (mv) [not SHE-corrected]	*	-42	37	-100	-28	*	*
pH	*	7	6.8	7.1	7.1	*	*
Temp (°C)	*	6	9.7	10	9	*	*
Spc. Cond. (µS/cm)	*	144	151	181	160	*	*
Turbidity (NTU)	*	89	44	19	33	*	*
Method of Sampling	low-flow	low-flow	low-flow	low-flow	low-flow	**	low-flow

* parameters not measured

** Normally sampled using low-flow method, however due to heavy rains and flooding, water was over PVC and inside casing. Therefore, it was sampled under similar conditions to an Artesian well.

MW-7D SHALLOW BEDROCK WELL

Parameter	23-May-01	29-Apr-02	10-Jun-03	24-May-04	24-May-05	15-Jun-06	23-May-07
As (µg/L)	*	*	*	*	N/A	N/A	N/A
TCE (µg/L)	*	*	*	*	N/A	N/A	N/A
Dissolved Oxygen (mg/L)	*	*	*	*	2.2	1.6	2.4
ORP (mv) [not SHE-corrected]	*	*	*	*	144	-65	61
pH	*	*	*	*	9.3	9.6	9.8
Temp (°C)	*	*	*	*	6.6	16	13
Spec. Condi. (µS/cm)	*	*	*	*	154	147	142
Turbidity (NTU)	*	*	*	*	5	11	71
Method of Sampling	WL	WL	Honda Pump and Bailer	WL	low-flow	low-flow	low-flow

* parameters not measured

WL = water levels only

MW-8D SHALLOW BEDROCK WELL

Parameter	23-May-01	29-Apr-02	10-Jun-03	24-May-04	23-May-05	15-Jun-06	23-May-07
As (µg/L)	*	*	*	*	N/A	N/A	N/A
TCE (µg/L)	*	*	*	*	2.6	2.3	N/A
Dissolved Oxygen (mg/L)	*	*	*	*	1.7	2.9	2.4
ORP (mv) [not SHE-corrected]	*	*	*	*	-150	28	72
pH	*	*	*	*	7.5	8.4	9.0
Temp (°C)	*	*	*	*	10	16	12
Spec. Condi. (µS/cm)	*	*	*	*	527	460	447
Turbidity (NTU)	*	*	*	*	36	12	67
Method of Sampling	WL	WL	Honda Pump and Bailer	WL	low-flow	low-flow	low-flow

* parameters not measured

WL = water levels only

0W-4SR OVERBURDEN WELL

Parameter	24-May-01	30-Apr-02	5-Jun-03	24-May-04	23-May-05	15-Jun-06	22-May-07
As (µg/L)	1.3	2	BDL	BDL	ND	ND	ND
TCE (µg/L)	BDL	BDL	BDL	BDL	BDL	ND	ND
Dissolved Oxygen (mg/L)	*	*	4.2	2.8	0.9	1	2.3
ORP (mv) [not SHE-corrected]	*	*	351	217	172	227	136
pH	*	*	5.5	5.5	5.4	5.4	5.5
Temp (°C)	*	*	10	9.4	8.3	12	11
Spec. Condi. (µS/cm)	*	*	252	242	242	164	164
Turbidity (NTU)	*	*	4	4	4	1	4
Method of Sampling	rapid purge, recover, & sample	rapid purge, recover, & sample	low-flow	low-flow	low-flow	low-flow	low-flow

* parameters not measured

ATTACHMENT C – Residential Well Sampling Data

Address	Lot #	Location	Sample Taken By	Date	Sample Number	BDL or ND	Cis- 1,2 DCE (µg/L)	TCE (µg/L)	Toluene (µg/L)	MTBE (µg/L)	TAME (µg/L)	Chloroform† (µg/L)	Acetone (µg/L)	Benzene (µg/L)	Total Xylenes (µg/L)
Ambient Groundwater Quality Standard (AGQS)							**70**	**5**	**1,000**	**13**	**140**	**6**	**6,000**	**5**	**10,000**
4	5-90	MOT_DW-1D	USGS	08/31/03	A63125-1					5.5					
4	5-90	MOT_DW-1	NHDES	03/03/04	A70866-2					4.0					
4	5-90	MOT_DW-1	NHDES	06/02/04	A74998-2					3.5					
4	5-90	MOT_DW-1	NHDES	09/07/04	A80886-2					2.5					
4	5-90	MOT_DW-1	NHDES	12/02/04	A84248-2					1.8					
4	5-90	MOT_DW-1C	NHDES	03/02/05	A87145-2					1.8					
4	5-90	MOT_DW-1C	NHDES	06/09/05	A91553-2					0.7					
4	5-90	MOT_DW-1C	NHDES	09/13/05	A97550-2					1.1					
4	5-90	MOT_DW-1C	NHDES	12/06/05	B1883-2					0.9					
4	5-90	MOT_DW-1C	NHDES	03/10/06	B5084-2					0.5			10	1.5	
4	5-90	MOT_DW-1C	NHDES	06/20/06	A603676002					0.5					
4	5-90	MOT_DW-1C	NHDES	09/11/06	A609088002					5.6					
4	5-90	MOT_DW-1C	NHDES	12/08/06	A612598002				0.5	**71**				0.7	0.8
4	5-90	MOT_DW-1C	NHDES®	01/09/07	A700342002					**66**				0.6	
4	5-90	200503022DW06	2ndWind	02/07/07	A701199001					**45**					
4	5-90	200503022DW06	2ndWind	03/09/07	A702162002					**35**					
4	5-90	MOT_DW-1C	NHDES	03/09/07	A702106002					**31**					
4	5-90	200503022DW06	2ndWind	04/25/07	A703746001					**19**					
4	5-90	200503022DW06	2ndWind	06/05/07	A705618004					**15**					
4	5-90	MOT_DW-1	NHDES	06/13/07	A706043002					**15**					
4	5-90	MOT_DW-1A	Watermark	10/04/07	A711925002					**21**					
4	5-90	MOT_DW-1A	Watermark	01/10/08	A800270002					7.5					
5	1-22	MOT_DW-6	NHDES	03/03/04	A70866-3	BDL									
6	5-91	MOT_DW-2C	USGS	08/31/03	A63125-2				15			5.1			
6	5-91	MOT_DW-2	NHDES	03/03/04	A70866-4	BDL									
6	5-91	MOT_DW-2B	NHDES	06/02/04	A74998-3							0.7			
6	5-91	MOT_DW-2B	NHDES	09/07/04	A80886-3							1.4			
6	5-91	MOT_DW-2B	NHDES	12/02/04	A84248-3			0.6							
6	5-91	MOT_DW-2B	NHDES®	12/30/04	A85123-2			0.5				0.6			
6	5-91	MOT_DW-2B	NHDES	03/02/05	A87145-3			1.0				0.6			
6	5-91	MOT_DW-2B	NHDES	06/09/05	A91553-3	BDL									
6	5-91	MOT_DW-2B	NHDES	09/13/05	A97550-3	BDL									
6	5-91	MOT_DW-2D	NHDES	12/06/05	B1883-3		0.5	1.2							
6	5-91	MOT_DW-2D	NHDES	03/10/06	B5084-3			0.6							
6	5-91	MOT_DW-2D	NHDES	06/20/06	A603676003			0.5							
6	5-91	MOT_DW-2D	NHDES	09/11/06	A609088003	ND									
6	5-91	MOT_DW-2D	NHDES	12/08/06	A612598003			0.9							

Address	Lot #	Location	Sample Taken By	Date	Sample Number	BDL or ND	Cis- 1,2 DCE (µg/L)	TCE (µg/L)	Toluene (µg/L)	MTBE (µg/L)	TAME (µg/L)	Chloroform† (µg/L)	Acetone (µg/L)	Benzene (µg/L)	Total Xylenes (µg/L)
Ambient Groundwater Quality Standard (AGQS)							**70**	**5**	**1,000**	**13**	**140**	**6**	**6,000**	**5**	**10,000**
6	5-91	MOT_DW-2D	NHDES	03/09/07	A702106003				0.8						
6	5-91	MOT_DW-2D	NHDES	06/13/07	No Sample	Couldn't gain access to basement tap during this sampling round									
6	5-91	MOT_DW-2D	Watermark	10/04/07	A711925003									0.5	
6	5-91	MOT_DW-2D	Watermark	01/10/08	A800270003										
7	1-21	MOT_DW-7	NHDES	12/04/03	A67819-2							0.7			
8	1-3	MOT_DW-3C	USGS	06/24/03	A59035-3				9.9						
8	1-3	MOT_DW-3A	NHDES	09/05/03	A63887-2	BDL									
8	1-3	MOT_DW-3	NHDES	12/04/03	A67819-3				1.4						
8	1-3	MOT_DW-3	NHDES®	01/12/04	A68986-2				0.9						
8	1-3	MOT_DW-3	NHDES	03/03/04	A70866-5				1.0						
8	1-3	MOT_DW-3	NHDES	06/02/04	A74998-4	BDL									
8	1-3	MOT_DW-3A	NHDES	09/07/04	A80886-4	BDL									
8	1-3	MOT_DW-3A	NHDES	09/13/05	A97550-4	BDL									
8	1-3	MOT_DW-3A	NHDES	12/06/05	B1883-4	BDL									
8	1-3	MOT_DW-3A	NHDES	03/10/06	B5084-4	BDL									
8	1-3	MOT_DW-3A	NHDES	06/20/06	A603676004	ND									
8	1-3	MOT_DW-3A	NHDES	09/11/06	A609088004	ND									
8	1-3	MOT_DW-3A	NHDES	12/08/06	A612598004	ND									
8	1-3	MOT_DW-3A	NHDES	03/09/07	A702106004	ND									
8	1-3	MOT_DW-3A	NHDES	06/13/07	A706043003	ND									
8	1-3	MOT_DW-3A	Watermark	10/04/07	A711925004	ND									
8	1-3	MOT_DW-3A	Watermark	01/10/08	A800270004	ND									
9	1-20	MOT_DW-8	NHDES	12/05/03	A67819-4	BDL									
10	1-4	MOT_DW-4	NHDES	06/06/03	A58095-2		0.8	1.0							
10	1-4	MOT_DW-4	NHDES®	06/19/03	A28825-2		1.1	1.3							
10	1-4	MOT_DW-4	NHDES	09/05/03	A63887-3		0.6	0.9							
10	1-4	MOT_DW-4	NHDES	12/05/03	A67819-5		0.8	1.3							
10	1-4	MOT_DW-4	NHDES	03/03/04	A70866-6		0.9	1.2							
10	1-4	MOT_DW-4	NHDES	06/02/04	A74998-5		0.5	0.8							
10	1-4	MOT_DW-4	NHDES	09/07/04	A80886-5		0.5	0.8							
10	1-4	MOT_DW-4	NHDES	03/02/05	A87145-5			0.8							
10	1-4	MOT_DW-4	NHDES	06/09/05	A91553-5			0.7							
10	1-4	MOT_DW-4	NHDES	09/13/05	A97550-6			0.5							
10	1-4	MOT_DW-4	NHDES	12/06/05	B1883-5			0.7							
10	1-4	MOT_DW-4	NHDES	03/10/06	B5084-5			0.7							
10	1-4	MOT_DW-4	NHDES	06/20/06	A603676005			0.8							

Address	Lot #	Location	Sample Taken By	Date	Sample Number	BDL or ND	Cis- 1,2 DCE (µg/L)	TCE (µg/L)	Toluene (µg/L)	MTBE (µg/L)	TAME (µg/L)	Chloroform† (µg/L)	Acetone (µg/L)	Benzene (µg/L)	Total Xylenes (µg/L)
Ambient Groundwater Quality Standard (AGQS)							**70**	**5**	**1,000**	**13**	**140**	**6**	**6,000**	**5**	**10,000**
10	1-4	MOT_DW-4	NHDES	09/11/06	A609088005			0.7							
10	1-4	MOT_DW-4A	NHDES	12/08/06	A612598005			0.7							
10	1-4	MOT_DW-4A	NHDES	03/09/07	A702106005			0.7							
10	1-4	MOT_DW-4A	NHDES	06/13/07	A706043004			0.7							
10	1-4	MOT_DW-4	Watermark	10/04/07	A711925005	ND									
10	1-4	MOT_DW-4	Watermark	01/10/08	A800270005	ND									
11	1-19	MOT_DW-9	NHDES	09/05/03	A63887-5				3.0						
11	1-19	MOT_DW-9	NHDES®	09/19/03	A64574-2				6.3						
11	1-19	200503022DW04	2ndWind	05/12/05	A90006-3				1.3						
15	1-18	MOT_DW-10	NHDES	09/05/03	A63887-6	BDL									
15	1-18	200503022DW03	2ndWind	05/03/05	A89493-5	BDL									
16	1-5	MOT_DW-5B	USGS	06/24/03	A59035-2					6.30	1.1				
16	1-5	MOT_DW-5	NHDES	09/05/03	A63887-7				0.6						
16	1-5	MOT_DW-5	NHDES®	09/19/03	A64574-3	BDL									
16	1-5	MOT_DW-5	NHDES	12/04/03	A67819-7	BDL									
16	1-5	MOT_DW-5	NHDES	03/03/04	A70866-8	BDL									
16	1-5	MOT_DW-5	NHDES	06/02/04	A74998-7	BDL									
16	1-5	MOT_DW-5	NHDES	09/07/04	A80886-7					8.4	1.4				
16	1-5	MOT_DW-5A	NHDES	03/02/05	A87145-6					**29**	3.6				
16	1-5	200503022DW5A	2ndWind	03/28/05	A87942-1					**25**	3.7				
16	1-5	200503022DW5A	2ndWind	05/12/05	A90006-2					7.5	1.0				
16	1-5	MOT_DW-5	NHDES	06/09/05	A91553-6					**18**	2.9				
16	1-5	200503022DW5A	2ndWind	07/28/05	A94665-1					**20**	2.6				
16	1-5	MOT_DW-5	NHDES	09/13/05	A97550-7					**9.8**	2.0				
16	1-5	200503022DW5A	2ndWind	09/21/05	A97924-8					**18**	1.0				
16	1-5	200503022DW5A	2ndWind	11/03/05	B754-1					**18**	2.2				
16	1-5	MOT_DW-5	NHDES	12/06/05	B1883-7					**18**	1.9				
16	1-5	MOT_DW-5	NHDES	03/10/06	B5084-7					**14**	1.8				
16	1-5	MOT_DW-5	NHDES	06/20/06	A603676007					2.8	ND				
16	1-5	MOT_DW-5	NHDES	09/11/06	A609088007					6.9	1.2				
16	1-5	MOT_DW-5	NHDES	12/08/06	A612598007					7.2	0.8				
16	1-5	200503022DW5A	2ndWind	01/09/07	A700401008					9.3	1.0				
16	1-5	MOT_DW-5	NHDES	03/09/07	A702106007					6.0	1.1				
16	1-5	MOT_DW-5	NHDES	06/13/07	A706043006					5.5	0.7				
16	1-5	MOT_DW-5	Watermark	10/04/07	A711925007					4.6	0.7				
16	1-5	MOT_DW-5	Watermark	01/10/08	A800270007					2.9	ND				
17	1-17	MOT_DW-11	NHDES	09/05/03	A63887-8	BDL									

Address	Lot #	Location	Sample Taken By	Date	Sample Number	BDL or ND	Cis- 1,2 DCE (µg/L)	TCE (µg/L)	Toluene (µg/L)	MTBE (µg/L)	TAME (µg/L)	Chloroform† (µg/L)	Acetone (µg/L)	Benzene (µg/L)	Total Xylenes (µg/L)
Ambient Groundwater Quality Standard (AGQS)							**70**	**5**	**1,000**	**13**	**140**	**6**	**6,000**	**5**	**10,000**
17	1-17	200503022DW02	2ndWind	05/12/05	A90006-4					1.8					
18	1-6	MOT_DW-12	NHDES	09/05/03	A63887-9				1.2	0.5					
18	1-6	MOT_DW-12	NHDES®	09/19/03	A64574-4				0.9						
18	1-6	200503022DW01	2ndWind	05/03/05	A89493-6					2.3					
31-33 Blueberry Rd	5-4	MOT_DW-13	NHDES	3/2/05	A87145-7					6.1					

BDL - Below detection limit
ND = Not Detected
Cis-1,2-DCE = Cis-1,2-Dichloroethene
µg/L = micrograms per Liter
TCE - Trichloroethene
MTBE - Methyl-T-Butyl-Ether
TAME = 2-Methoxy-2-methyl-Butane
† Chloroform is not a Site chemical of concern; probably due to bleaching after well installation.
® = Resample
2nd Wind = SecondWind (Oil Remediation & Compliance Bureau Contractor)

ATTACHMENT D - 13 December 2007 Site Inspection

Five-Year Review Site Inspection Checklist
Mottolo Pig Farm, Raymond, New Hampshire

("N/A" refers to "not applicable")

I. SITE INFORMATION	
Site name: Mottolo Pig Farm	**Date of inspection:** 13 December 2007
Location and Region: Raymond, New Hampshire, USEPA Region I	**EPA ID:** NHD980503361
Agency, office, or company leading the five-year review: United States Army Corps of Engineers New England District	**Weather/temperature:** Overcast, ~25°F, 4-6 inches of snow on the ground

Remedy Includes: (Check all that apply)

- □ Landfill cover/containment
- □ Access controls
- ■ Institutional controls
- □ Groundwater pump and treatment
- □ Surface water collection and treatment
- □ Other
- ■ natural attenuation
- □ Groundwater containment
- □ Vertical barrier walls

Attachments: ■ Inspection team roster attached ■ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Sharon Perkins (Name) Project Manager (Title) 13 December 2007 (Date)
   Interviewed ■ at Site □ at office □ by phone Phone no. ______
   Problems, suggestions; □ Report attached TCE and Arsenic increases in some wells. Nature and extent of pathways in the fractured bedrock are not known, and may be affected by continued offsite development.

2. **O&M staff** ______ (Name) ______ (Title) ______ (Date)
   Interviewed □ at Site □ at office □ by phone Phone no. ______
   Problems, suggestions; □ Report attached ______

3.	**Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply. Agency ________________ Contact ________________ __________ _____ _______ Name Title Date Phone no. Problems; suggestions; ☐. Report attached ____________________ Agency ________________ Contact ________________ __________ _____ _______ Name Title Date Phone no. Problems; suggestions; ☐. Report attached ____________________ Agency ________________ Contact ________________ __________ _____ _______ Name Title Date Phone no. Problems; suggestions; ☐. Report attached ____________________ Agency ________________ Contact ________________ __________ _____ _______ Name Title Date Phone no. Problems; suggestions; ☐. Report attached ____________________
4.	**Other interviews** (optional) ☐. Report attached.

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)				
1.	**O&M Documents**			
	☐ O&M manual	☐ Readily available	☐ Up to date	■ N/A
	☐ As-built drawings	☐ Readily available	☐ Up to date	■ N/A
	☐ Maintenance logs	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
2.	**Site-Specific Health and Safety Plan**	☐ Readily available	☐ Up to date	■ N/A
	☐ Contingency plan/emergency response plan	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
3.	**O&M and OSHA Training Records**	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
4.	**Permits and Service Agreements**			
	☐ Air discharge permit	☐ Readily available	☐ Up to date	■ N/A
	☐ Effluent discharge	☐ Readily available	☐ Up to date	■ N/A
	☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	■ N/A
	☐ Other permits	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
5.	**Gas Generation Records**	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
6.	**Settlement Monument Records**	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
7.	**Groundwater Monitoring Records**	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
8.	**Leachate Extraction Records**	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
9.	**Discharge Compliance Records**			
	☐ Air	☐ Readily available	☐ Up to date	■ N/A
	☐ Water (effluent)	☐ Readily available	☐ Up to date	■ N/A
	Remarks			
10.	**Daily Access/Security Logs**	☐ Readily available	☐ Up to date	■ N/A
	Remarks			

IV. O&M COSTS

1. **O&M Organization**

■. State in-house
□. PRP in-house
□. Federal Facility in-house
□. Other______________________________

□. Contractor for State
□. Contractor for PRP
□. Contractor for Federal Facility

2. **O&M Cost Records**

■. Readily available ■. Up to date
■. Funding mechanism/agreement in place
Original O&M cost estimate__________________ □. Breakdown attached

Total annual cost by year for review period if available

From	**1 Jan 07**	**To**	**31 Dec 07**	**~$2,000**		□. **Breakdown attached**
	Date		**Date**	**Total Cost**		
From	**1 Jan 06**	**To**	**31 Dec 06**	**~$2,000**		□. **Breakdown attached**
	Date		**Date**	**Total Cost**		
From	**1 Jan 05**	**To**	**31 Dec 05**	**~$2,000**		□. **Breakdown attached**
	Date		**Date**	**Total Cost**		
From	**1 Jan 04**	**To**	**31 Dec 04**	**~$2,000**		□. **Breakdown attached**
	Date		**Date**	**Total Cost**		
From	**1 Jan 03**	**To**	**31 Dec 03**	**~$2,000**		□. **Breakdown attached**
	Date		**Date**	**Total Cost**		

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: ______________________________

V. ACCESS AND INSTITUTIONAL CONTROLS □. Applicable □. N/A

A. Fencing

1. **Fencing damaged** □. Location shown on Site map □. Gates secured ■. N/A

Remarks______________________________

B. Other Access Restrictions

1. **Signs and other security measures** □. Location shown on Site map □. N/A

Remarks. . ______________________________

C. Institutional Controls (ICs)		
1.	**Implementation and enforcement** Site conditions imply ICs not properly implemented Site conditions imply ICs not being fully enforced Type of monitoring (*e.g.*, self-reporting, drive by) ______ Frequency ______ Responsible party/agency ______ Contact Sharon Perkins (Name) / Project Manager (Title) / 13 Dec 07 (Date) / (603) 271-6805 (Phone no.) Reporting is up-to-date Reports are verified by the lead agency Specific requirements in deed or decision documents have been met Violations have been reported Other problems or suggestions: ☐ Report attached	 x☐ Yes ☐ No N/A ☐ Yes ☐ No ■ N/A ■ Yes ☐ No ☐ N/A ■ Yes ☐ No ☐ N/A ☐ Yes ☐ No ■ N/A ☐ Yes ☐ No ■ N/A
2.	**Adequacy** ■ ICs are adequate ☐ ICs are inadequate ☐ N/A Remarks Since fence was removed, vandalism acts have ceased. Some All Terrain Vehicle Tracks near Brook A Wells.	
D. General		
1.	**Vandalism/trespassing** ☐ Location shown on Site map ■ No vandalism evident Remarks ______	
2.	**Land use changes onsite** ■ N/A Remarks ______	
3.	**Land use changes off site** ☐ N/A Remarks ______	
VI. GENERAL SITE CONDITIONS		
A. Roads ☐ Applicable ■ N/A		
1.	**Roads damaged** ☐ Location shown on Site map ☐ Roads adequate ☐ N/A Remarks ______	

B. Other Site Conditions
Remarks ______________________________

VII. LANDFILL COVERS ☐ Applicable ■ N/A			
A. Landfill Surface			
1.	**Settlement** (Low spots) Areal extent________ Remarks________	☐ Location shown on Site map Depth________	☐ Settlement not evident
2.	**Cracks** Lengths________ Widths________ Depths________ Remarks________	☐ Location shown on Site map	☐ Cracking not evident
3.	**Erosion** Areal extent________ Remarks________	☐ Location shown on Site map Depth________	☐ Erosion not evident
4.	**Holes** Areal extent________ Remarks________	☐ Location shown on Site map Depth________	☐ Holes not evident
5.	**Vegetative Cover** ☐ Grass ☐ Cover properly established ☐ No signs of stress ☐ Trees/Shrubs (indicate size and locations on a diagram) Remarks________		
6.	**Alternative Cover (armored rock, concrete, etc.)** ☐ N/A Remarks________		
7.	**Bulges** Areal extent________ Remarks________	☐ Location shown on Site map Height________	☐ Bulges not evident

8.	**Wet Areas/Water Damage**	□ Wet areas/water damage not evident	
	□ Wet areas	□ Location shown on Site map	Areal extent______
	□ Ponding	□ Location shown on Site map	Areal extent______
	□ Seeps	□ Location shown on Site map	Areal extent______
	□ Soft subgrade	□ Location shown on Site map	Areal extent______
	Remarks______		
9.	**Slope Instability** □ Slides	□ Location shown on Site map	□ No evidence of slope instability
	Areal extent______		
	Remarks______		
B. Benches	□ Applicable □ N/A		
	(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)		
1.	**Flows Bypass Bench**	□ Location shown on Site map	□ N/A or okay
	Remarks______		
2.	**Bench Breached**	□ Location shown on Site map	□ N/A or okay
	Remarks______		
3.	**Bench Overtopped**	□ Location shown on Site map	□ N/A or okay
	Remarks______		
C. Letdown Channels	□ Applicable □ N/A		
	(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)		
1.	**Settlement**	□ Location shown on Site map	□ No evidence of settlement
	Areal extent______	Depth______	
	Remarks______		
2.	**Material Degradation**	□ Location shown on Site map	□ No evidence of degradation
	Material type______	Areal extent______	
	Remarks______		
3.	**Erosion**	□ Location shown on Site map	□ No evidence of erosion
	Areal extent______	Depth______	
	Remarks______		

4.	**Undercutting** ☐ Location shown on Site map ☐ No evidence of undercutting Areal extent__________ Depth__________ Remarks______________________________
5.	**Obstructions** Type__________ ☐ No obstructions ☐ Location shown on Site map Areal extent__________ Size__________ Remarks______________________________
6.	**Excessive Vegetative Growth** Type__________ ☐ No evidence of excessive growth ☐ Vegetation in channels does not obstruct flow ☐ Location shown on Site map Areal extent__________ Remarks______________________________
D. Cover Penetrations ☐ Applicable ☐ N/A	
1.	**Gas Vents** ☐ Active ☐ Passive ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______________________________
2.	**Gas Monitoring Probes** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______________________________
3.	**Monitoring Wells** (within surface area of landfill) ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______________________________
4.	**Leachate Extraction Wells** ☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition ☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A Remarks______________________________
5.	**Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A Remarks______________________________

E. Gas Collection and Treatment ☐ Applicable ☐ N/A	
1.	**Gas Treatment Facilities** ☐ Flaring ☐ Thermal destruction ☐ Collection for reuse ☐ Good condition ☐ Needs Maintenance Remarks______
2.	**Gas Collection Wells, Manifolds and Piping** ☐ Good condition ☐ Needs Maintenance Remarks______
3.	**Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings) ☐ Good condition ☐ Needs Maintenance ☐ N/A Remarks______
F. Cover Drainage Layer ☐ Applicable ☐ N/A	
1.	**Outlet Pipes Inspected** ☐ Functioning ☐ N/A Remarks______
2.	**Outlet Rock Inspected** ☐ Functioning ☐ N/A Remarks______
G. Detention/Sedimentation Ponds ☐ Applicable ☐ N/A	
1.	**Siltation** Areal extent______ Depth______ ☐ N/A ☐ Siltation not evident Remarks______
2.	**Erosion** Areal extent______ Depth______ ☐ Erosion not evident Remarks______
3.	**Outlet Works** ☐ Functioning ☐ N/A Remarks______
4.	**Dam** ☐ Functioning ☐ N/A Remarks______

H. Retaining Walls ☐ Applicable ☐ N/A	
1.	**Deformations** ☐ Location shown on Site map ☐ Deformation not evident Horizontal displacement__________ Vertical displacement__________ Rotational displacement__________ Remarks__________
2.	**Degradation** ☐ Location shown on Site map ☐ Degradation not evident Remarks__________
I. Perimeter Ditches/Off-Site Discharge ☐ Applicable ☐ N/A	
1.	**Siltation** ☐ Location shown on Site map ☐ Siltation not evident Areal extent__________ Depth__________ Remarks__________
2.	**Vegetative Growth** ☐ Location shown on Site map ☐ N/A ☐ Vegetation does not impede flow Areal extent__________ Type__________ Remarks__________
3.	**Erosion** ☐ Location shown on Site map ☐ Erosion not evident Areal extent__________ Depth__________ Remarks__________
4.	**Discharge Structure** ☐ Functioning ☐ N/A Remarks__________
VIII. VERTICAL BARRIER WALLS ☐ Applicable ■ N/A	
1.	**Settlement** ☐ Location shown on Site map ☐ Settlement not evident Areal extent__________ Depth__________ Remarks__________
2.	**Performance Monitoring** Type of monitoring__________ ☐ Performance not monitored Frequency__________ ☐ Evidence of breaching Head differential__________ Remarks__________

IX. GROUNDWATER/SURFACE WATER REMEDIES ■. Applicable □. N/A	
A. Groundwater Extraction Wells, Pumps, and Pipelines □. Applicable ■. N/A	
1.	**Pumps, Wellhead Plumbing, and Electrical** □. Good condition □. All required wells properly operating □. Needs Maintenance □. N/A Remarks________________________________
2.	**Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances** □. Good condition □. Needs Maintenance Remarks________________________________
3.	**Spare Parts and Equipment** □. Readily available □. Good condition □. Requires upgrade □. Needs to be provided Remarks________________________________
B. Surface Water Collection Structures, Pumps, and Pipelines □. Applicable ■. N/A	
1.	**Collection Structures, Pumps, and Electrical** □. Good condition □. Needs Maintenance Remarks________________________________
2.	**Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances** □. Good condition □. Needs Maintenance Remarks________________________________
3.	**Spare Parts and Equipment** □. Readily available □. Good condition □. Requires upgrade □. Needs to be provided Remarks________________________________

C. Treatment System	☐. Applicable ■. N/A
1.	**Treatment Train** (Check components that apply) ☐. Metals removal ☐. Oil/water separation ☐. Bioremediation ☐. Air stripping ☐. Carbon adsorbers ☐. Filters______ ☐. Additive (*e.g.*, chelation agent, flocculent)______ ☐. Others______ ☐. Good condition ☐. Needs Maintenance ☐. Sampling ports properly marked and functional ☐. Sampling/maintenance log displayed and up to date ☐. Equipment properly identified ☐. Quantity of groundwater treated annually______ ☐. Quantity of surface water treated annually______ Remarks______
2.	**Electrical Enclosures and Panels** (properly rated and functional) ☐. N/A ☐. Good condition ☐. Needs Maintenance Remarks______
3.	**Tanks, Vaults, Storage Vessels** ☐. N/A ☐. Good condition ☐. Proper secondary containment ☐. Needs Maintenance Remarks______
4.	**Discharge Structure and Appurtenances** ☐. N/A ☐. Good condition ☐. Needs Maintenance Remarks______
5.	**Treatment Building(s)** ☐. N/A ☐. Good condition (esp. roof and doorways) ☐. Needs repair ☐. Chemicals and equipment properly stored Remarks______
6.	**Monitoring Wells** (pump and treatment remedy) ☐. Properly secured/locked ☐. Functioning ☐. Routinely sampled ☐. Good condition ☐. All required wells located ☐. Needs Maintenance ☐. N/A Remarks______
D. Monitoring Data	
1.	Monitoring Data ■. Is routinely submitted on time ■. Is of acceptable quality
2.	Monitoring data suggests: ☐. Groundwater plume is effectively contained ☐. Contaminant concentrations are declining

D. Natural Attenuation
1. **Monitoring Wells** (natural attenuation remedy) ■ Properly secured/locked ☐ Functioning ■ Routinely sampled ☐ Good condition ■ All required wells located ■ Needs Maintenance ☐ N/A Remarks_Monitoring well surface completions are in great shape, except for those near Brook A that are seasonally submerged. None of the wells have been redeveloped since they were installed in 1988, potentially biasing data high or low, depending on the parameter and the well's hydraulics.

X. OTHER REMEDIES
If there are remedies applied at the Site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS
A. Implementation of the Remedy
Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.). The NA remedy goal is to monitor the natural degradation of chlorinated VOCs and Arsenic following overburden source area removal and SVE operations. Because the flow pathways in the bedrock are not understood, it is not known if potential receptors north and west of the Site area exposed to Site groundwater contaminants. Several well-specific increases and decreases in contaminant concentrations are likely related to changes in local and regional groundwater levels interacting with potential residual source area contaminants. A few well trends do not follow regional groundwater or surface water trends. In the case of arsenic, this includes seasonally saturated weathered bedrock, whose thickness is not known but likely varies across the Site. It is suggested that the current well sampling plan be reviewed and augmented to include additional parameters and/or analytes be measured during routine well sampling, to include field water quality parameters (such as turbidity), and dissolved metals such as iron and manganese.
B. Adequacy of O&M
Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy. Outside of well maintenance, all O&M activities are adequate. It is not known if the concrete structure in the Well Shed covers a dug well or a bedrock supply well for former Piggery, but tubing and the presence of a large boiler suggest the well had a usable capacity. This well may represent a pathway for contaminants to enter the groundwater. It should be inspected/rehabilitated (if possible) as a groundwater monitoring well, log it geophysically if it is useful as a bedrock supply well, sample it, or abandon it in accordance with state of New Hampshire regulations.

C.	**Early Indicators of Potential Remedy Problems**
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. Since NHDES removed the chain link fence surrounding the Site, incidents of vandalism have not occurred. Having the wells completed as flush mounts has aided in reducing vandalism. Some ATV tracks have been noticed at the Site, but at this time have not caused erosion problems or impacted surface water and groundwater sampling. Levels of contaminants have not decreased as expected. Arsenic levels appear very high enough to suggest that additional wells be sampled to explore for anomalous readings.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Geophysically log selected open hole bedrock monitoring wells onsite, and work up the data to identify trends in transmissive fracture orientation and the geologic controls. Merge the data with that already collected by the USGS in the residential wells. Assess if current offsite groundwater receptors are adequately covered by the current sampling program, and evaluate impacts from proposed development using the already published photolineament data as a guide. Reduce residential well sampling to spring and fall (high and low groundwater conditions) as defined by seasonal high and low discharge periods at USGS Stream Gage 01073587 on the Exeter River at Haigh Road, Near Brentwood, New Hampshire.

ATTACHMENT E – Interview Documentation

INTERVIEW DOCUMENTATION FORM

The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.

Name	Title/Position	Organization	Date
Paul Doherty	Abutting Property Owner	NA	20 Feb 08
Keith Hanson	Abutting Property Owner	NA	20 Feb 08
Chris Rose	Town Manager	Town of Raymond	20 Feb 08
Richard Mailhot	Building and Health Inspector	Town of Raymond	20 Feb 08
Harry McClard	Abutting Property Owner	NA	20 Feb 08
Rebecca Poullot	Abutting Property Owner	NA	24 Feb 08
Wayne Wolfe	Abutting Property Owner	NA	25 Feb 08

<table>
<tr><th colspan="4">INTERVIEW RECORD</th></tr>
<tr><td colspan="2">Site Name: Mottolo Pig Farm</td><td colspan="2">EPA ID No.: NHD980503361</td></tr>
<tr><td colspan="2">Subject: Third Five-Year Review</td><td>Time: 0955</td><td>Date: 20 Feb 2008</td></tr>
<tr><td colspan="2">Type: <u>Telephone</u> . Visit . Other
Location of Visit:</td><td colspan="2">Incoming . Outgoing</td></tr>
<tr><th colspan="4">CONTACT MADE BY</th></tr>
<tr><td>Name: Drew Clemens</td><td>Title: Geologist</td><td colspan="2">Organization: USACE</td></tr>
<tr><th colspan="4">INDIVIDUAL CONTACTED:</th></tr>
<tr><td>Name: Paul Doherty</td><td>Title: Abutting Property Owner</td><td colspan="2">Organization: NA</td></tr>
<tr><td></td><td colspan="3">Street Address: 4 Strawberry Lane
City, State, Zip: Raymond, NH 03077</td></tr>
<tr><th colspan="4">SUMMARY OF CONVERSATION</th></tr>
<tr><td colspan="4">Q1: What is your overall impression of the project and Site?
A1: If he had known, he would not have purchased his current home.

Q2: Are you aware of any issues the five-year review should focus on?
A2: None.

Q3: Who should USACE speak to in the community to solicit local input?
A3: Not aware of anyone in the community. Recommended discussing project with Sharon Perkins of NHDES. Mr. Doherty is very pleased with her level of coordination and information distribution.

Q4: Is the remedy functioning as expected?
A4: Not sure what else could be done. He still has contaminated well water requiring $6,000 in treatment equipment (for MTBE and TCE) before it can be used.

Q5: Is the Town actively involved in the Site or do they show an active interest?
A5: He is not aware of any town involvement, for he has only worked with Sharon Perkins of NHDES.

Q6: Have there been any changes in the Site or surrounding property in the last 5 years, or are changes planned?
A6: Increased housing development. A 50-60 home development is planned for the area west of the Site.</td></tr>
</table>

INTERVIEW RECORD			
Site Name: Mottolo Pig Farm		**EPA ID No.**: NHD980503361	
Subject: Third Five-Year Review		**Time:** 1045 AM	**Date**: 20 Feb 2008
Type: **Telephone** . Visit . Other Location of Visit:		Incoming . **Outgoing**	
CONTACT MADE BY			
Name: Drew Clemens	**Title**: Geologist	**Organization**: USACE	
INDIVIDUAL CONTACTED:			
Name: Keith Hanson	**Title**: Abutting Property Owner	**Organization**: NA	
		Street Address: 8 Strawberry **City, State, Zip**: Raymond, NH 03077	

SUMMARY OF CONVERSATION

Q1: What is your overall impression of the project and Site?
A1: Happy with the quarterly sampling program, and cannot see the Site. Is concerned about the potential impact of new housing developments.

Q2: Are you aware of any issues the five-year review should focus on?
A2: Not aware of any issues. All response actions have been well done.

Q3: Who should USACE speak to in the community to solicit local input?
A3: Not aware of anyone else in the community.

Q4: Is the remedy functioning as expected?
A4: Yes.

Q5: Is the Town actively involved in the Site or do they show an active interest?
A5: Not aware of any involvement outside of NHDES.

Q6: Have there been any changes in the Site or surrounding property in the last 5 years, or are changes planned?
A6: New 15 home development completed west of the Site. Newer, larger development planned, and roads have been cut into the woods. Not sure about the number of homes.

INTERVIEW RECORD

Site Name: Mottolo Pig Farm	**EPA ID No.:** NHD980503361
Subject: Third Five-Year Review	**Time:** 1130 AM / **Date:** 20 Feb 2008
Type: <u>Telephone</u> . Visit . Other Location of Visit:	Incoming . **Outgoing**

CONTACT MADE BY

Name: Drew Clemens	**Title:** Geologist	**Organization:** USACE

INDIVIDUAL CONTACTED:

Name: Chris Rose	**Title:** Town Manager	**Organization:** Town of Raymond

Street Address: 4 Epping Street
City, State, Zip: Raymond, NH 03077

SUMMARY OF CONVERSATION

Q1: What is your overall impression of the project and Site?
A1: Has been town manager for 4 months, and was not aware of the Mottolo Pig Farm Superfund Site. Forwarded EPA's Site summary web page to Mr. Rose.

Q2: Are you aware of any issues the five-year review should focus on?
A2: He has never heard of any issues or problems from this part of Raymond.

Q3: Who should USACE speak to in the community to solicit local input?
A3: Suggested calling Richard Maillot, the Town's Building and Health Inspector, who has been with the Town Office for over 20 years.

Q4: Is the remedy functioning as expected?
A4: Cannot ascertain until he has reviewed EPA's web site and discussed with Mr. Maillot, the Town's Building and Health Inspector.

Q5: Is the town actively involved in the site or do they show an active interest?
A5: No.

Q6: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A6: Not aware of any changes.

INTERVIEW RECORD			
Site Name: Mottolo Pig Farm		**EPA ID No.**: NHD980503361	
Subject: Third Five-Year Review		**Time:** AM/PM	**Date**: 2008
Type: Telephone . Visit . Other Location of Visit:		**Incoming** . Outgoing	
CONTACT MADE BY			
Name: Drew Clemens	**Title**: Geologist	**Organization**: USACE	
INDIVIDUAL CONTACTED:			
Name: Richard Mailhot	**Title**: Building and Health Inspector	**Organization**: Town of Raymond	
		Street Address: 4 Epping Street **City, State, Zip**: Raymond, NH 03077	

SUMMARY OF CONVERSATION

Q1: What is your overall impression of the project and site?
A1: Monitoring is happening, based on reports received from NHDES. He has never been on the site.

Q2: Are you aware of any issues the five-year review should focus on?
A2: Has not received any complaints from homeowners.

Q3: Who should USACE speak to in the community to solicit local input?
A3: No one in the community is involved with activities related to the site.

Q4: Is the remedy functioning as expected?
A4: Yes.

Q5: Is the Town actively involved in the site or do they show an active interest?
A5: The Town Library is the administrative record holder, but the Town does not interpret or disseminate information related to the site per direction from NHDES.

Q6: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A6: Development east and south of the Site was completed 1-2 years ago. Development northeast of the site for a cluster of 27 homes has not proceeded past the clearing and grubbing stage. Per the town clerk (Donna Giberson), development is headed up by Gillingham Road LLC (85-87 Boston Street, Everett, MA) formed by the owner Alan Segall (sp?).

Q7: Have any of the new domestic wells west or south of the site had unusually high arsenic values?
A7: No. If any of the new domestic wells had arsenic values exceeding the federal and state standards, the well would not be permitted for use and some form of remediation taken place.

<table>
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<tr><td colspan="2">Site Name: Mottolo Pig Farm</td><td colspan="2">EPA ID No.: NHD980503361</td></tr>
<tr><td colspan="2">Subject: Third Five-Year Review</td><td>Time: 440 PM</td><td>Date: 20 Feb 2008</td></tr>
<tr><td colspan="2">Type: <u>Telephone</u> . Visit . Other
Location of Visit:</td><td colspan="2">Incoming . Outgoing</td></tr>
<tr><th colspan="4">CONTACT MADE BY</th></tr>
<tr><td>Name: Drew Clemens</td><td>Title: Geologist</td><td colspan="2">Organization: USACE</td></tr>
<tr><th colspan="4">INDIVIDUAL CONTACTED:</th></tr>
<tr><td>Name: Harry McClard</td><td>Title: Abutting Property Owner</td><td colspan="2">Organization: NA</td></tr>
<tr><td></td><td colspan="3">Street Address: 16 Strawberry Lane
City, State, Zip: Raymond, NH, 03077</td></tr>
<tr><th colspan="4">SUMMARY OF CONVERSATION</th></tr>
<tr><td colspan="4">Q1: What is your overall impression of the project and site?
A1: NHDES has been very good about communicating results. He has no concerns about the site itself, but has only lived in the house for 2 years.

Q2: Are you aware of any issues the five-year review should focus on?
A2: His only concern is the occasional MTBE detection.

Q3: Who should USACE speak to in the community to solicit local input?
A3: He was not aware of anyone else in the community USACE should contact.

Q4: Is the remedy functioning as expected?
A4: Yes.

Q5: Is the Town actively involved in the site or do they show an active interest?
A5: He has not seen any Town activity near the Site, and has not heard of any Town activity related to the Site.

Q6: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A6: He was not aware of development activity before 2006. A new development on West site of Blueberry Road near the Exeter River is on hold, perhaps due to the housing market slump.</td></tr>
</table>

INTERVIEW RECORD

Site Name: Mottolo Pig Farm	**EPA ID No.:** NHD980503361	
Subject: Third Five-Year Review	**Time:** AM/PM	**Date:** 2008
Type: **Telephone** . Visit . Other Location of Visit:	Incoming . **Outgoing**	

CONTACT MADE BY

Name: Drew Clemens	**Title:** Geologist	**Organization:** USACE

INDIVIDUAL CONTACTED:

Name: Rebecca Poullot	**Title:** Abutting Property Owner	**Organization:** NA
	Street Address: 10 Strawberry Lane **City, State, Zip:** Raymond, NH, 03077	

SUMMARY OF CONVERSATION

Q1: What is your overall impression of the project and site?
A1: No issues with the project or the site.

Q2: Are you aware of any issues the five-year review should focus on?
A2: None.

Q3: Who should USACE speak to in the community to solicit local input?
A3: Not aware of anyone specific.

Q4: Is the remedy functioning as expected?
A4: Yes.

Q5: Is the Town actively involved in the site or do they show an active interest?
A5: Not sure. Have never seen anyone from the Town at or near the Site and have never heard of anyone from the Town discuss the Site.

Q6: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A6: No changes at the Site. New development is located west of Blueberry Road near Exeter River.

INTERVIEW RECORD

Site Name: Mottolo Pig Farm	**EPA ID No.:** NHD980503361
Subject: Third Five-Year Review	**Time:** 925 AM — **Date:** 25 Feb 2008
Type: Telephone . Visit . Other Location of Visit:	**Incoming** . Outgoing

CONTACT MADE BY

Name: Drew Clemens	**Title:** Geologist	**Organization:** USACE

INDIVIDUAL CONTACTED:

Name: Wayne Wolfe	**Title:** Abutting Property Owner	**Organization:** NA
	Street Address: 6 Strawberry Lane **City, State, Zip:** Raymond, NH, 03077	

SUMMARY OF CONVERSATION

Q1: What is your overall impression of the project and site?
A1: Has been in house only 2 years. No signs of construction or vandalism. Have seen and heard motor cycles and all terrain vehicles driving around the site.

Q2: Are you aware of any issues the five-year review should focus on?
A2: None.

Q3: Who should USACE speak to in the community to solicit local input?
A3: Not aware of anyone specific.

Q4: Is the remedy functioning as expected?
A4: Yes, but the property owners are drawing a sample for independent laboratory confirmation. Suggested testing for arsenic and letting the spigot run for 20 minutes at as high a rate as possible (property owners have had no problems with well going dry). Have heard that Mr. Mottolo has hired a consulting firm to conduct the water sampling, and would like to make sure that results and interpretations are provided to the homeowners.

Q5: Is the Town actively involved in the site or do they show an active interest?
A5: Wayne was not sure if anyone from the Town was involved with the Site.

Q6: Have there been any changes in the site or surrounding property in the last 5 years, or are changes planned?
A6: No changes at the Site since they moved in two years ago. New development is located west of Blueberry Road near Exeter River, but thinks the project has run out of money and lots are being sold individually.

ATTACHMENT F – Detailed Groundwater Analysis

REGIONAL GROUNDWATER AND SURFACE WATER TREND ANALYSIS

The first and second FYRs concluded that there was no seasonal impact on the Site's groundwater and surface water chemistry (USEPA, 2003, 1998), but regional data not readily available during these review periods was examined to assess potential overburden and bedrock groundwater trends as well as any links with surface water (USGS, 2008a, b, and c). As part of the third FYR, USACE evaluated groundwater and surface water data from 1992 to March 2008 to identify potential seasonality effects on groundwater flow patterns and contaminant concentrations. This part of the review focused on seasonal highs and lows for groundwater levels and mean stream discharge for the nearest surface water, overburden, and bedrock groundwater long term monitoring stations maintained by the United States Geological Survey (USGS), 2008a, 2008b, 2008c,(Figure F-1).

Groundwater levels are measured monthly at the two USGS wells (one screened in the overburden material [NH-DDW 46]and one in the bedrock [NH-HTW 5]). The data indicates that yearly high water levels typically occur in the month of May (Figure F-2). Conversely, the yearly low usually takes place in October. This was true for both the highs and the lows in at least six out of the twelve years evaluated. Given the distance from the site, these timeframes may not coincide exactly with site conditions, but in the absence of site-specific head data, the regional well data provide an indication of when seasonal high and low water table conditions occur (high in May, low in October, fairly typical for the New England region).

Mean stream discharge at the USGS stream gage in the Exeter River near Brentwood, New Hampshire has been recorded daily since 1996 (Figure F-1 and F-2). A consistent springtime flood occurs every year during which mean discharge jumps one order of magnitude. The response time for groundwater levels to react to precipitation is likely very short due to the thin overburden and numerous outcrops. Daily surface water data indicate seasonal high flows in the April to early May timeframe, with mean stream discharge above 200 cubic feet per second (cfs) and seasonal low flows in the October timeframe, with flow less than 4 cfs.

The findings of this evaluation, presented here and in the main body of the text indicate that changes in groundwater table elevations (seasonal and in response to site activities, such as removal of the groundwater interceptor trench) result in subtle changes to site hydraulics, such as groundwater flow patterns and discharge areas. However, a definitive relationship was not found between seasonal fluctuations in groundwater and contaminant concentration trends, based on the current data sets.
In order to further assess seasonality effects on contaminant concentrations, sampling is needed during both high and low water table conditions. A correlation between elevated concentrations and high water table conditions would be of interest, as it might support the presence of remaining contaminant mass in this zone.

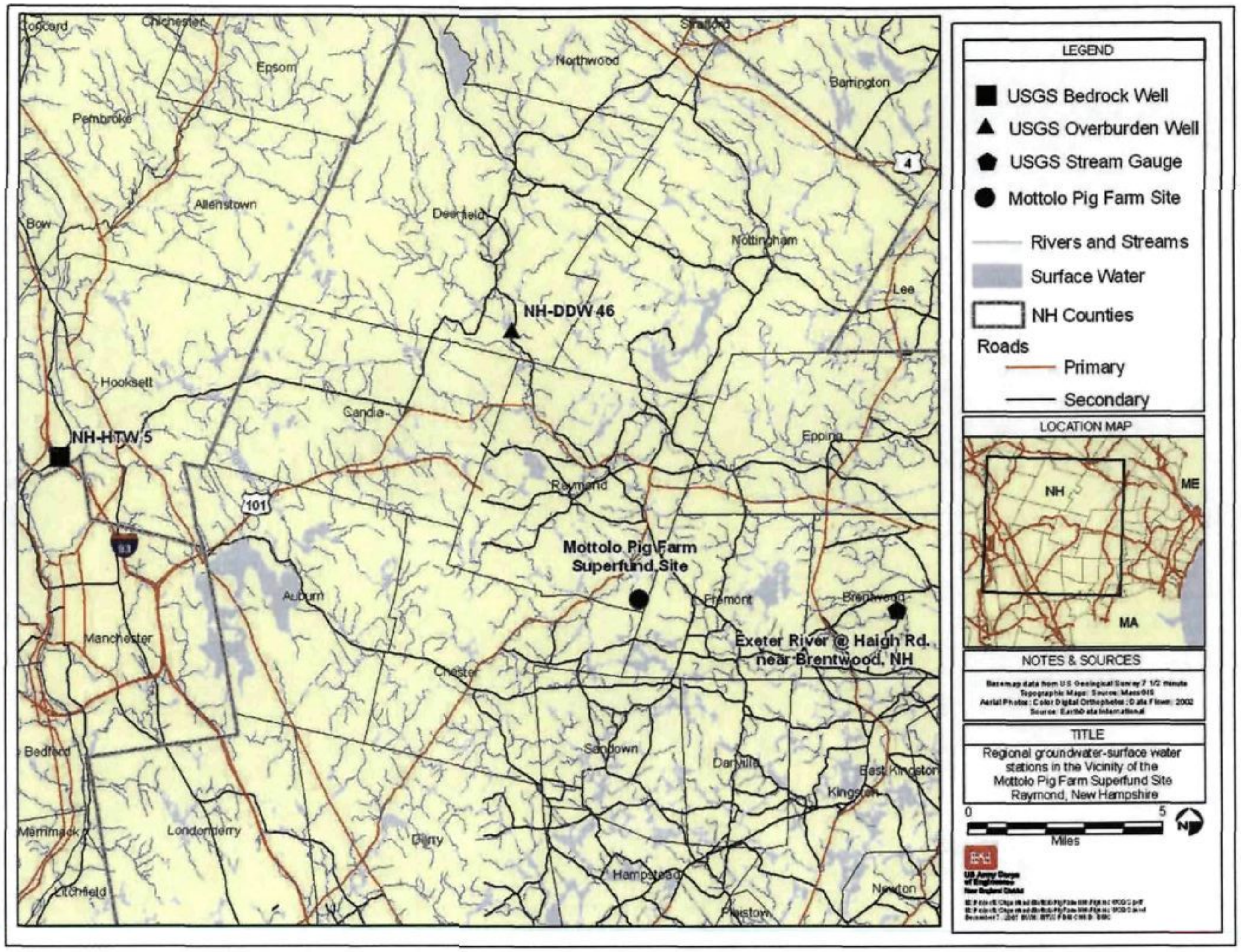

Figure F-1. Location of USGS groundwater and surface water stations used for seasonal trend analysis, and the Mottolo Pig Farm. *Superfund Site, Raymond, NH.*

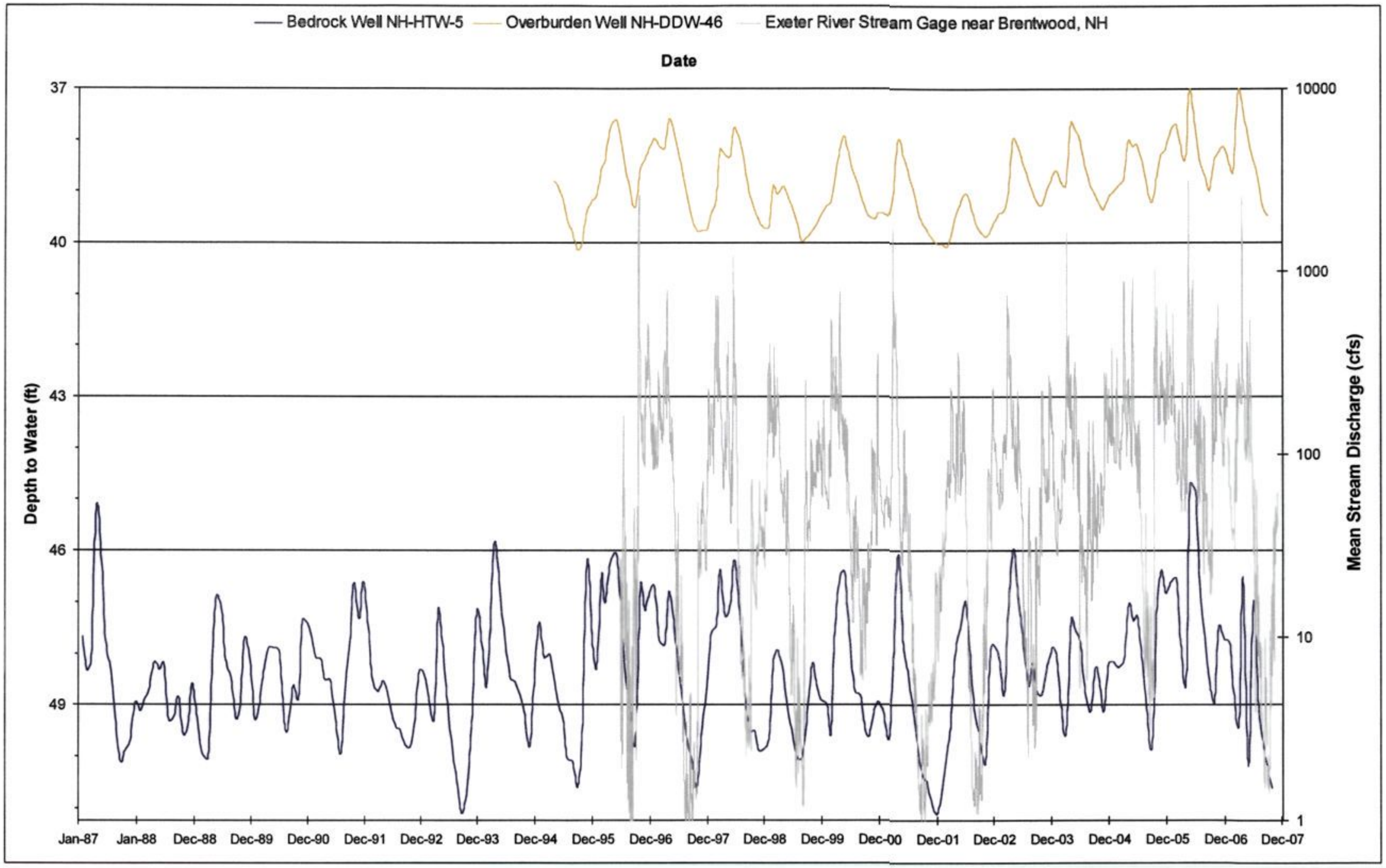

Figure F-2. Plot of regional groundwater trends in overburden and bedrock aquifer systems, and stream discharge flow, showing regional relationships between changes in groundwater levels and stream discharge rate (USGS, 2007a, b, c).

Background

Periodic monitoring of groundwater quality was conducted during the RI from April through December 1988 (Balsam Environmental Consultants, Inc., 1990). No groundwater sampling was conducted between 1989 and 1992. Periodic monitoring of groundwater and surface water quality at the Site was initiated in 1992, one year after completing the FS (Balsam Environmental Consultants, Inc., 1991). Surface water monitoring ceased in 2004 as sampling results showed no contamination detected. The long-term groundwater monitoring program was conducted in accordance with the Remedial Action Work Plan, with results for 2003 and 2007 summarized in Table 4. Results of groundwater and surface water monitoring for the first three FYRs were documented in reports submitted to EPA by NHDES (1992-2007).

Site water levels from wells with few dry measurements, and those with few or no observations of groundwater flowing over their casings, were converted to elevation and plotted to assess trends over time (Table F-1, Figure F-3). These data were also overlain onto results from the nearest USGS surface water, overburden, and bedrock groundwater long term monitoring stations (Figure F-3). Where fall and spring data were collected, the water table varies seasonally across the site by 6 to 10 feet, and follows the general pattern of the USGS Exeter River stream gage. A large range of water levels can potentially change the oxidation-reduction conditions of the saturated soil and bedrock over the course of a year, and can lead to seasonal fluctuations in contaminant concentrations, and retard or enhance contaminant mobility, especially for arsenic (USEPA, 2007a. Wang and others, 2006). A large range in water levels can also potentially bring groundwater in direct contact with any residual sources within the zone of fluctuation, leading to sporadic and/or seasonal spikes in groundwater contamination.

Starting in 1999, data collection was scaled back to annual spring measurements, so the water level trends have dramatically muted variations unless sampling was done during a high discharge event, such as spring snowmelt (e.g., spring 2000). It is also apparent that high groundwater conditions have occurred earlier than some of the sampling events, based on surface water discharge and regional bedrock groundwater levels, suggesting that sample timing should be moved to late April.

The USGS monitored water levels in MW-21D from October 2002 through October 2003 as part of a fractured bedrock hydrogeologic investigation funded by EPA (NHDES, 2004). Data recording intervals for most of the period were too long (20-30 minute intervals) to capture brief hydraulic stresses, such as drilling or domestic well pumps cycling on and off. Data was collected at 10-minute intervals between August and October 2003, when most of the local overburden aquifer at higher elevations is unsaturated and pumping influence should be at its maximum. Results show brief drawdown events whose response curves are similar to what one would expect from short duration pumping wells a few hundred feet away from the observation well. This suggests that residential well pumping may enhance contaminant distribution at the Site.

Table F-1. Calculated water table elevations for Site wells with the most continuous set of measurements (NHDES, 1992-2007d)(see also Table 2).

	4/9/1997	10/28/1997	4/1/1998	9/9/1998	5/25/1999	4/24/2000	5/23/2001	4/29/2002	6/5/2003	5/24/2004	5/19/2005	6/14/2006	5/22/2007
MW-7D	224.22	216.32	224.37	217.91	221.87	224.09	222.43	223.44	223.46	223.49	224.11	224.60	223.42
MW-8S	225.35	216.67	224.94	217.91	222.54	226.56	222.39	224.20	223.85	224.22	223.80	225.65	225.08
MW-8D	219.78	219.75	220.86	220.98	220.84	220.60	221.46	222.35	222.66	208.31	212.77	216.08	217.40
MW-9D	215.40	204.94	215.24	206.93	213.36	217.06	213.16	215.04	215.19	215.41	214.36	215.81	214.96
MW-12S	185.24	183.92	185.27	183.86	185.23	185.78	184.72	185.49	185.22	185.78	181.02	185.40	185.45
MW-20S	222.20	216.27	221.96	217.38	221.53	222.74	221.05	222.22	221.98	222.54	221.87	222.22	222.21
MW-20D	222.32	214.55	221.35	214.94	219.34	221.62	218.00	220.63	219.86	220.23	220.24	220.05	219.20
MW-21S	225.43	220.73*	225.22	220.73*	222.63†	227.14	222.16	224.16	223.66	224.60	223.85	225.33	225.19
MW-21D	222.43	214.70	221.42	214.81	222.16	221.73	217.79	220.55	219.29	219.76	220.17	219.67	219.22
MW-23S‡	218.59	213.24	218.26	214.30	218.17	219.20	220.18	220.89	220.67	221.34	220.72	221.12	221.09
MW-23D‡	218.66	213.12	218.26	214.17	218.10	219.32	220.17	220.90	220.71	221.50	220.75	221.28	221.25
MO-2DR	186.94	185.69	187.62	186.64	187.00	188.51	186.59	187.60	187.65	187.79	187.46	188.32**	187.37
MO-5DR	181.30	180.22	181.41	179.82	181.20	181.61	181.18	181.51	181.52	181.66	181.46	181.59	181.61
OW-2DR	205.00	200.60	205.61	201.78	203.65	208.36	204.42	208.27	207.83	209.07	207.57	209.01	208.69
OW-4SR	210.77	206.61	213.19	208.11	209.62	216.33	211.55	215.71	215.22	216.23	215.22	217.67	216.54

* Elevation biased high due to using elevation assumed to be 0.2 ft below bottom of well due to dry period (Table 2).
** Biased low due to using elevation of casing as the head value for a flowing well. (Table 2). Several wells were not plotted due to numerous "flowing well" readings.
‡ 2001 casing elevations were used for converting all depth measurements to elevation (Table 2).
† 10 May 2005 measurement used, for the 25 May 2007 value exceeds the well depth (Table 2).

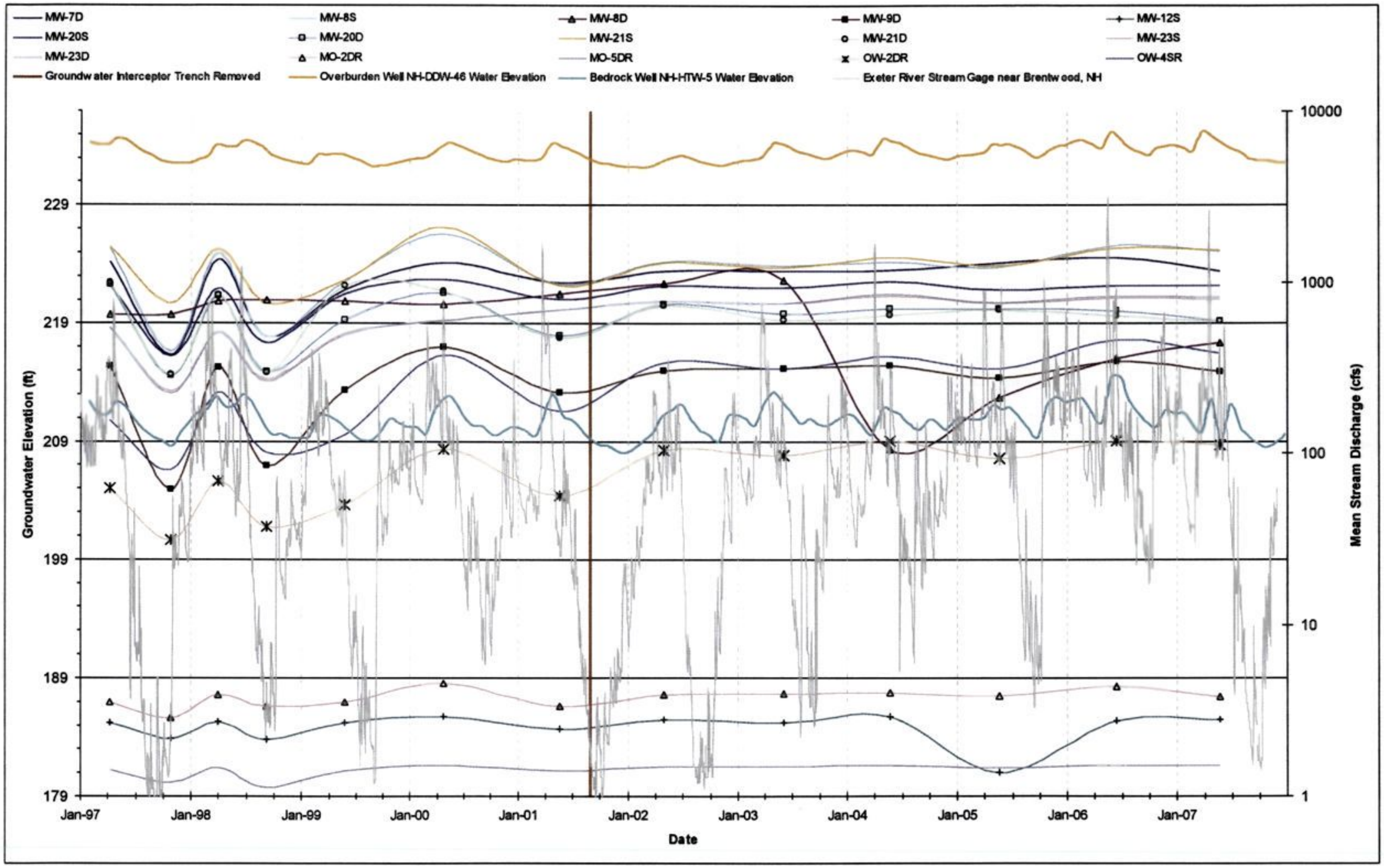

Figure F-3. Site water elevations overlain onto regional surface water discharge and water level data (USGS, 2008a, b, c, NHDES 1992-2007d).

Wells MW-8D and MW-12S have anomalous groundwater elevation trends relative to the other wells. The water level graph for MW-12S (overburden) parallels the other wells, with the exception of the May 2005 reading, which appears to be anomalously low. The water level graph for MW-8D (bedrock) does not fluctuate as much as the other wells, experienced a sudden drop in 2004, and has been recovering slowly since then. The lack of fluctuation and slow recovery could also be a sign of well construction issues affecting its communication with the formation and response to hydraulic events. An alternate interpretation, based on sample collection data combined with these curves, is that these wells may be set in a different hydrogeologic unit with a much lower hydraulic conductivity.

Due to the large number of flowing wells with unknown head elevations, the overburden head data could not be contoured to assess groundwater flow direction. These wells represent discharge areas, near Brook A: MW-12D, MW-22S, MW-22D, MO-2S, MO-3SR, and MO-3DR. The northwest-southeast overburden groundwater divide north of the former Piggery Building (Figure 2) identified in the RI/FS is present during normal and high groundwater conditions. During drought conditions, this divide likely shifts location, and the discharge areas also may shift to the north.

CONTAMINANT TRENDS AND SEASONAL GROUNDWATER FLUCTUATIONS

An effort was made to evaluate the influence of seasonal groundwater fluctuations on contaminant trends, specifically for chlorinated solvent compounds and arsenic. A summary of TCE and arsenic trends is provided in the main body of the report, in Table 7 and in Figures 6 and 7 (trend charts). Regional groundwater and surface water measurement data are included in the contaminant trend plots in Attachment B.

Chlorinated Solvent Compounds

Overburden and bedrock groundwater contaminant data were plotted over time on log scale against their respective regional water level data set (Attachment B). The timing of the three significant hydraulic events at the Site (installation and removal of the SVE System, and removal of the groundwater interceptor trench) were also shown on the graphs in Attachment B. TCE trends are summarized in Table 7 and shown in Figure 6.

Based on the steady or slightly increasing trends and elevated concentrations of TCE at specific wells (MO-3SR, MO-5DR, and MW-22D), there may be a residual mass of contamination remaining in the subsurface, serving as a continuing source of groundwater contamination. If present, it is not known if it occurs in soil and/or bedrock, as a single zone of remaining (untreated) contamination or as multiple isolated pockets of contamination. Fundamentally, areas upgradient of these wells would be implicated as potential TCE source areas. Alternately, given that these wells are all located some distance downgradient of the site, these levels/trends could also be attributed to the lag time for the plume to travel and reach this area. Other wells at the site, most notably OW-2DR and MO-3DR, have shown decreasing trends.

Groundwater level fluctuations would be a factor only if the zone of fluctuation intercepts a residual source area intermittently, or is below a mass of contaminated soil in the unsaturated (vadose) zone above it. Hypothetically, periods of high water levels and increased recharge moving through a source zone would lead to an increase in contaminant concentrations in wells near the source zone. At locations farther downgradient, a decrease in contamination might be observed due to dilution effects (slug of clean water recharge).

An effort was made to assess the potential influence of seasonal groundwater fluctuations on VOC concentrations, using TCE as representative of all the volatiles (Table 7 and Attachment B). Given the limited number of fall groundwater level measurements, no definitive conclusions could be made in this regard.

Arsenic

Overburden and bedrock groundwater arsenic data were plotted over time on log scale against their respective regional water level data set (Attachment B). The timing of the three significant hydraulic events at the Site (installation and removal of the SVE System, and removal of the groundwater interceptor trench) were also overlain on the graphs. Arsenic trends are summarized in Table 7 and shown in Figure 7.

Up until late 1999, concentrations tended to be highly variable, with erratic spikes and lows. After that point, more consistent trends in the data are observed. This timeframe coincides with the implementation of consistent sampling methodology.

The arsenic spatial distribution is similar to that observed in the RI, but the values in some wells have doubled since 1989. No arsenic samples have been collected from wells south of the groundwater divide (SBA) as part of the groundwater monitoring program. Sampling during the RI was not spatially or temporally consistent in and around the SBA.

Based on the strong increasing trend for arsenic at MO-3SR, the area upgradient of this well may represent a potential arsenic source area. Again, an effort was made to assess the potential influence of seasonal groundwater fluctuations on arsenic concentrations (Table 7 and Attachment B). Given the limited number of fall groundwater level measurements, no definitive conclusions could be made in this regard.

Arsenic at this Site has several potential sources, and concentrations in groundwater vary from nondetect to over 1,000 µg/L (NHDES, 1998-2007, Balsam Environmental Consultants, Inc., 1990). Boundary and offsite monitoring wells sampled during the RI were not spatially or temporally consistent, but did show detections up to 41.3 µg/l north of the 250 ft north of the Blueberry Hill Road-Randy Lane intersection (Figure 1) (Balsam Environmental Consultants, Inc., 1991). Due to the high values observed at the Site since 1992, its limited but persistent extent, and recent developments in understanding arsenic fate and transport, arsenic is evaluated in detail. Arsenic occurs as inorganic and organic species, each with different fate, transport, and toxicity characteristics. The reactions among the arsenic species are governed by aquifer matrix composition, groundwater chemistry and oxidation-reduction conditions, microbial activity, and adsorption-precipitation processes (O'Day and others, 2004). Unlike organic contaminants, arsenic does not degrade into eventually innocuous compounds, but remains in place, and can mobilize, stabilize, and remobilize in response to changes in aquifer geochemical conditions. Such changes in valence state and species alter both its mobility and its toxicity (USEPA, 2007a, b, Wang and others, 2006).

The small number of overburden studies looking at New England and Great Lakes glacial soils indicates that some soils release inorganic arsenic into groundwater up to 340 µg/L (e.g., Thomas, 2007, Peters and others, 2003, 2002, Hon and others, 2002). These levels are far below the moderate to high values measured at the Site (NHDES, 1998-2007, Balsam Environmental Consultants, Inc., 1990). The New England and Great Lakes studies did identify iron, methane, and to a lesser extent manganese, exhibited significant control on arsenic fate and transport, whereas sulphate and phosphate showed little control on these processes.

In general, inorganic arsenic naturally present in the +V valence state (less mobile) can be converted to the more mobile +III valence state by strongly reducing conditions (large, negative ORP values). Alkaline conditions (high pH) also tend to keep arsenic in solution, while acidic conditions (low pH) would tend to make it come out of solution. Examples of site activities/conditions that can change subsurface geochemistry include: large fluctuations in water table elevation, major changes in vegetation, and construction and removal of subsurface remediation systems.

The following table summarizes several potential mechanisms that could generate elevated arsenic concentrations in groundwater:

Mechanism	Site Conditions
Strong reducing conditions can mobilize naturally-occurring inorganic arsenic, by reducing it from the less mobile +V form to the more mobile (soluble) +III form.	Unlikely. Strong reducing conditions not present, as evidenced by positive ORP values and relatively high dissolved oxygen levels.
Alkaline conditions would tend to keep arsenic in solution	Possible. Localized area of alkaline conditions near SBA at wells MW-7D and MW-8D.
Turbid groundwater samples containing high levels of suspended solids, which can have metals entrained in them.	Cannot assess, as turbidity data not available for all wells. Possible where wells are screened in silty overburden units, such as at MO-3SR. Would need additional data in order to assess: turbidity data, and analysis of both filtered and unfiltered samples for arsenic.
Residual source of arsenic-containing contamination (organic or inorganic) in soil or bedrock above, at or below the water table.	Possible, based on: - Strong increasing trend at MO-3SR. - Solid waste daylights at base of the lower swale. - Available arsenic soil and groundwater data for the FDDA are insufficient to rule this area out as a potential source area. - Potential for piggery wastes and/or arsenic-based pesticides.

In summary, there are several potential, plausible mechanisms that could be responsible for the elevated and increasing arsenic concentrations at the Site. Without knowing which mechanism is at work, and the location of any remaining source area, there is additional uncertainty regarding contaminant migration pathways in both overburden and through fractured bedrock networks.

No further thorough assessment of arsenic's extent and the controls on its mobility (or lack thereof) can be done without additional soil and groundwater characterization (comprehensive field water quality, turbidity, iron, and manganese data from the overburden and bedrock wells) (e.g., USEPA, 2007a, 2007b, Wang and others, 2006).

Field Water Quality Data

Parameters such as dissolved oxygen (DO), pH, specific conductance, and oxidation reduction potential (ORP) are used to assess low-flow sampling adequacy, and provide significant insights to general aquifer chemical and biologic conditions. Data is only available from four wells, and has not been collected as part of the surface water sampling program (Figure F-4), so site-wide aquifer conclusions cannot be drawn. The ORP data was not corrected to the Standard Hydrogen Electrode (SHE), but even with the typical 200+-mv addition to the field measurement, aquifer conditions are not suitable for reductive dechlorination. This is reinforced by the 1-4 mg/l range of DO present.

The anomalously high and increasing pH readings in MW-7D and MW-8D cannot be attributed to leaking bentonite or cement solutions entering the well screen, given that the wells were constructed in 1988, and any grout curing issues would have resolved by now. The cause of the elevated (alkaline) pH is currently unknown. One possible explanation is that some piggery-related wastes (e.g., carcasses), or caustic (lime) treated waste materials may have been disposed of within or near the SBA (Figure 2 and Figure F-4). The horizontal extent of the pH anomaly could not be evaluated due to the lack of data from surrounding wells, but the data suggest that higher levels are present in the overburden. If measurements of total/dissolved iron and manganese concentrations in well water samples were available, the data could be used to support conclusions related to pH and oxidation state.

Groundwater Gradients

Water levels measured in overburden wells during the RI suggested an east-west groundwater divide, separating flow to the north and south was present near the piggery (Figure 2). This divide may have extended into the weathered portion of the bedrock. At depth, in the fractured but unweathered bedrock, flow paths are more heavily controlled by local and regional recharge and discharge zones, geologic structures and gradient. Since the RI, a significant portion of the site has undergone remediation, liner and interceptor trench removal, and regrading, suggesting that hydraulic conditions since 2001 may not be the same as those observed in the RI. This is supported by chemical trends in the wells, where large oscillations in TCE and arsenic concentrations cease between 1999 and 2001.

RI and monitoring water level data indicate that upward gradients are present in a small portion of Brook A and north of the remediated source area at the MW-22 well cluster. The magnitude of the vertical gradients is not known due to the lack of water level measurements from overflowing wells. This prevents contouring of the existing head data to assess changes in gradient. It is also not known how these gradients seasonally change in magnitude or location within Brook A.

During regionally significant drought periods, the Site overburden water table drops below the bottom of the wells screens for MW-7S, MW-9S, and MW-21S, making them ineffective potentiometric surface and chemistry monitoring points during low groundwater conditions.

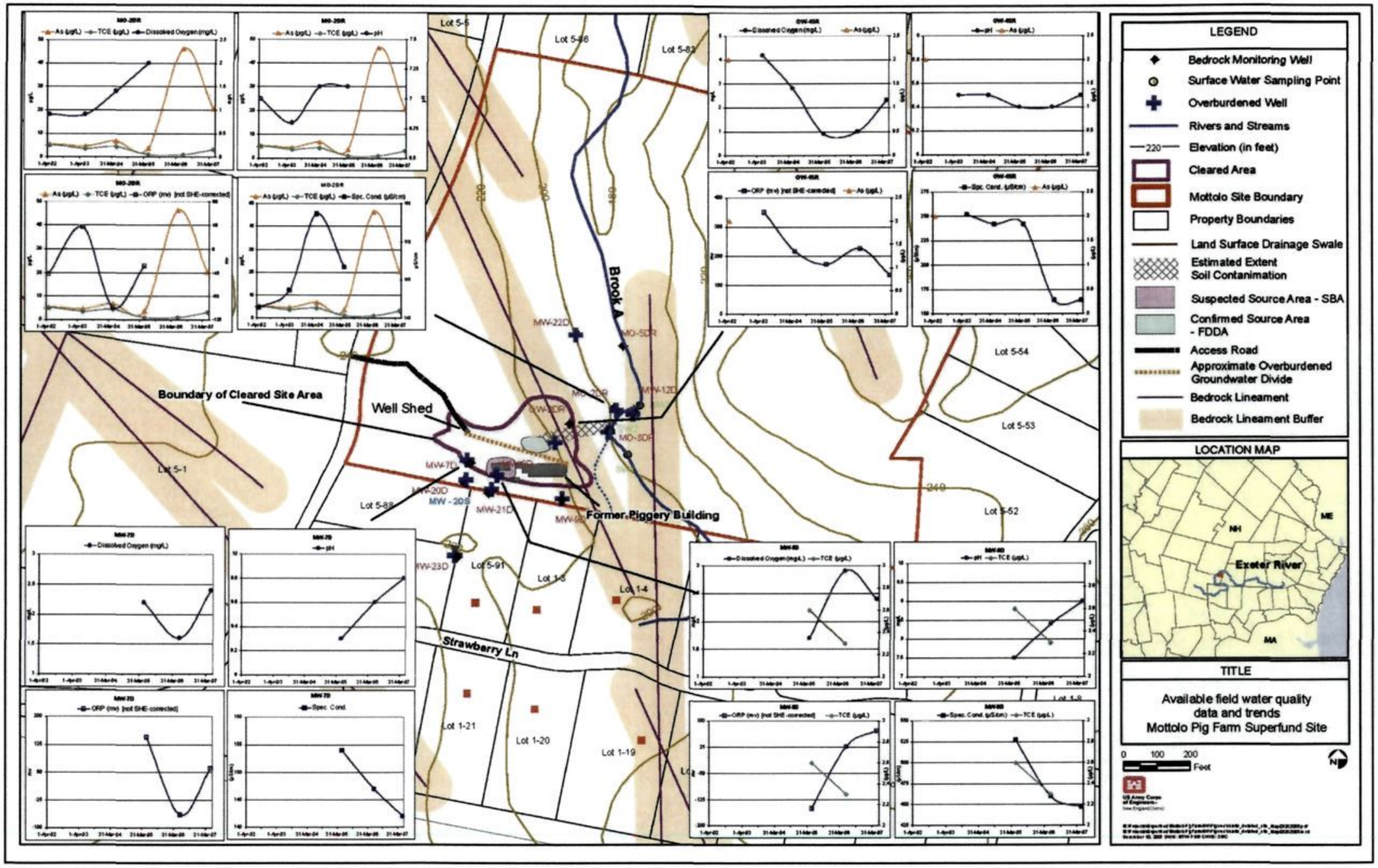

Figure F-4. Plots of selected field water quality parameters with arsenic and TCE detections (NHDES, 2002-2007).

Groundwater Flow Paths

The Site's RI accurately describes the overburden groundwater pathways and hydraulics between the known source areas and Brook A (Balsam Environmental Consultants, Inc., 1990), and these conclusions likely extend into the weathered bedrock. The RI combined the weathered bedrock and unweathered bedrock systems into one unit, which could be misleading, as hydraulic properties likely vary and change with depth. Weathered bedrock tends to be highly fractured and may resemble anisotropic soils. Groundwater flow within the unweathered bedrock occurs through a network of discrete fractures.

When the RI investigation was executed, seismic exploration methods that could image fracture zones and weathered bedrock were not economically available. Only one bedrock well out of 17 penetrated a high yield fracture system, illustrating the difficulties in finding and monitoring the bedrock groundwater plumbing system in the 1980s. Many of the existing bedrock wells are shallow, hence only monitoring the weathered bedrock zone. In contrast, the residential wells located on Strawberry Lane are much deeper, and at least two wells penetrated fracture zones within the deeper unweathered bedrock that are potentially connected to the Site.

Fracture sets present in the subsurface offer potential conduits for migration of contamination off site, and are the product of local and regional geologic structure. The precise orientation of these fractures is currently unknown. Some of the lineaments identified (Figure 3) may represent the surface expression of bedrock geology structure, including foliation, folding and major fractures. Based on lineaments, there may be fractures aligned to the northwest-southeast that could be capable of transmitting contamination off site.

Pre-RI sampling by the state of New Hampshire showed indications of trace amounts of site-related contaminants present in the domestic supply wells north of the site at Lot 3, 21, 45 and 50 (Balsam Environmental Consultants, Inc., 1990).

In summary, the potential migration of contaminants through bedrock poses additional uncertainty, especially in light of increased development and the accompanying increased pumping pressures on the bedrock aquifer, as the zone of influence for bedrock wells can be relatively large, anisotropic, and can pull groundwater from relatively large distances. Pressures on bedrock aquifers can also pull contamination present in the overburden down into the bedrock.

CONCLUSIONS

In conclusion, concentration trends indicate the potential presence of remaining residual TCE and arsenic source area(s). Trends were compared to seasonal groundwater fluctuations, but no definitive relationship was found. There are several potential mechanisms that could be responsible for the elevated arsenic levels, but additional investigations would be required to determine which mechanism is at work. The hydraulic connection between overburden groundwater and bedrock, and the nature of groundwater flow in fractured bedrock introduces additional uncertainty regarding the potential for unmonitored flowpaths to exist offsite.